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(54) ELECTRONIC DEVICE AND ITS MANUFACTURING METHOD, AND WIRING BOARD AND SEALING MEMBER USED FOR MANUFACTURE OF ELECTRONIC DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To suppress a rise in pressure in a cavity part by expansion of steam in the cavity part in an electronic device wherein the cavity is provided.

SOLUTION: The electronic device comprises a wiring board where wiring (a conductor pattern) is provided on the surface of an insulating board, a chip- like element provided on the wiring substrate a conductive member connecting and

estimal terminal of the chip element with a wiring of the wiring boad, and a sealing member which seals the periphery of the chip-like element. The electronic device has the cavity between the wiring substrate and the chip-like element. The sealing member comprises a steam transmitting member which transmits the steam and a cap member which does not transmit or hardly transmits the steam. The steam transmitting member communicates the inside of the cavity and the outside of the sealing member.

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CLAIMS

[Claim(s)]

[Claim 1] The wiring substrate with which wiring (conductor pattern) was prepared on the surface of the insulating substrate, and the chip-like component prepared on said wiring substrate, The conductive member which connects the external terminal of said chip-like component, and wiring of said wiring substrate, It is the electronic instrument which consists of a closure member which closes the perimeter of said chip-like component, and has a cavity between said wiring substrate and said chip-like component. Said closure member It is the electronic instrument which consists of a steam transparency member which penetrates a steam, and a cap member which is hard to penetrate or it does not penetrate a steam, and is characterized by said steam transparency member opening the exterior of said closure member for free passage in said cavity.

[Claim 2] It is the electronic instrument according to claim 1 which the crevice which has the space where said closure member is larger than the volume of said chip-like component is prepared, and is characterized by preparing said chip-like component in the cavity surrounded in the crevice of said wiring substrate and said closure member.

[Claim 3] Said steam transparency member is an electronic instrument according to claim 1 or 2 which is a film-like and is characterized by being prepared between said wiring substrates and said cap members.

[Claim 4] Said chip-like component is an electronic instrument given in any 1

term of claim 1 thru/or claim 3 which is the surface acoustic element in which the blind-like electrode (tandem-type electrode) was prepared on the surface of piezoelectric material, and is characterized by being prepared so that said blind-like electrode and said wiring substrate may face each other.

[Claim 5] The chip-like component mounting process of arranging a chip-like component on the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after said chip-like component mounting process. The steam permeability film with which the field which arranges said chip-like component carried out opening of said wiring substrate is formed. Said closure process The manufacture approach of the electronic instrument characterized by putting the cap member which is hard to penetrate or it does not penetrate a steam, and pasting up said cap member and said wiring substrate through said steam permeability film on said chip-like component.

[Claim 6] The chip-like component mounting process of arranging a chip-like component on the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after said chip-like component mounting process. The film adhesion process of pasting up the steam permeability film with which the field which arranges said chip-like component on said wiring substrate carried out opening of said chip-like component mounting process, A chip-like component is arranged on said wiring substrate, and it has the chip connection process of connecting wiring of said

wiring substrate, and the external terminal of said chip-like component. Said closure process The manufacture approach of the electronic instrument characterized by putting the cap member which is hard to penetrate or it does not penetrate a steam, and pasting up said cap member and said wiring substrate through said steam permeability film on said chip-like component.

[Claim 7] The wiring substrate formation process which forms the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, The chip-like component mounting process of arranging a chip-like component on the wiring substrate formed with said wiring substrate formation process, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after said chip-like component mounting process. The wiring formation process with which said wiring substrate formation process forms said wiring in the front face of said insulating substrate, It has the film adhesion process of pasting up the steam permeability film in which the field which arranges said chip-like component carried out opening, on said insulating substrate after said wiring formation process. Said closure process The manufacture approach of the electronic instrument characterized by putting the cap member which is hard to penetrate or it does not penetrate a steam, and pasting up said cap member and said wiring substrate through said steam permeability film on said chip-like component.

[Claim 8] The chip-like component mounting process of arranging a chip-like component on the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after

said chip-like component mounting process. The steam permeability member to which said closure process penetrates a steam on the wiring substrate with which said chip-like component was mounted, The manufacture approach of the electronic instrument characterized by consisting of a cap member which is hard to penetrate or it does not penetrate a steam, putting the closure member in which the crevice which has larger space than the volume of said chip-like component was formed, and pasting up and closing said closure member and said wiring substrate.

[Claim 9] Said chip-like component mounting process is the manufacture approach of an electronic instrument given in any 1 term of claim 5 thru/or claim 8 characterized by arranging the surface acoustic element in which the blind-like electrode (tandem-type electrode) was formed on the surface of piezoelectric material so that said blind-like electrode may face said wiring substrate.

[Claim 10] When a chip-like component is prepared in the field in which the insulating closure ingredient is prepared on the wiring substrate with which wiring (conductor pattern) was prepared on the surface of the insulating substrate, and said closure ingredient on said wiring substrate was prepared It is the wiring substrate which are said wiring substrate and a wiring substrate with which a cavity is prepared between said chip-like components, and which is used for manufacture of an electronic instrument, and said closure ingredient is a steam permeability film which penetrates a steam, and is characterized by the field in which said chip-like component is prepared carrying out opening.

[Claim 11] The closure member characterized by preparing the crevice which serves as a steam permeability member which is a closure member which closes the chip-like component mounted on the wiring substrate, and penetrates a steam from the cap section which is hard to penetrate or it does not penetrate a steam, and has larger space than the volume of said chip-like component.

[Claim 12] Said steam permeability member is a closure member according to claim 11 which is a film-like and is characterized by being prepared in the effective area side of said crevice of said cap section.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] About an electronic instrument and its manufacture approach, especially this invention is applied to the electronic instrument using a surface acoustic element, and relates to an effective technique.

[0002]

[Description of the Prior Art] Conventionally, the SAW filter component using a surface acoustic wave (SAW is called below Surface Acoustic Wave;) is used for the band-pass filter for mobile communication equipment, such as a cellular phone, (band pass filter).

[0003] Said SAW filter component is a component with which the blind-like electrode (tandem-type electrode) was prepared in the front face of piezo-electric substrates, such as lithium niobate (LiNbO3), lithium tantalate (LiTaO3), and Xtal. At this time, the electrode for the input said whose blind-like electrode carries out excitation vibration of the surface wave, and the electrode for an output which receives said surface wave by which excitation vibration was carried out, and is transformed into an electrical signal are prepared. Moreover, at this time, it

roughly divides into said blind-like electrode, there are electrode structure of a delayed type and electrode structure of a resonance mold in it, and it is chosen according to an application or a property.

[0004] With said SAW filter component, if alternating voltage (electrical signal) is impressed to the blind-like electrode for said input, distortion will arise in said piezo-electric substrate according to the piezo-electric effect, a surface wave will be excited, and the front face of said piezo-electric substrate will vibrate. The surface wave which vibrates on the front face of said piezo-electric substrate spreads said piezo-electric substrate top, reaches the blind electrode for said output, and is received.

[0005] It depends on the period (spacing) of said blind-like electrode for the frequency of the surface wave excited at this time. Therefore, in the blind-like electrode for said output, only the surface wave (electrical signal) of a specific frequency can be received, and it can use as a band-pass filter.

[0006] Moreover, since the electronic instrument using said SAW filter component needs the space for exciting and spreading said surface wave for the front face of said SAW filter component, the thing of a ceramic package gestalt is used conventionally.

[0007] Wiring pasted up said SAW filter component in the ceramic case which made and was full, and connected the external terminal of said SAW filter component, and wiring (terminal) of said ceramic case by the bonding wire, and said ceramic package has closed opening of said ceramic case with the cap made from a metal or a ceramic.

[0008] However, since in the case of said ceramic package the volume of said ceramic case is large and specific gravity is also large, equipment becomes on a large scale and heavy. Therefore, there was a problem that the miniaturization of said mobile communication equipment and lightweight-izing were difficult.

[0009] So, in recent years, a miniaturization and in order to lightweight-ize, like semiconductor devices [electronic instrument / which used said SAW filter component], such as BGA (Ball Grid Array) and CSP (Chip Size Package), flip

chip mounting of said SAW filter component is carried out on the wiring substrate (tape career) in which wiring was formed on the front face of a tape-like insulating substrate, and the approach of closing the perimeter of said SAW filter component with an insulator is proposed.

[0010] As said electronic instrument which mounted said SAW filter component on said tape career As shown in drawing 7 , for example, on said tape career (dielectric substrate) by which wiring 2 was formed on the insulating substrate 1 After connecting flip chip mounting, i.e., the terminal area of the blind-like electrode 302 of said SAW filter component and said wiring 2, for said SAW filter component 3 by the conductive member (golden bump) 4, The film 7 for the closures is put on said SAW filter component 3, the periphery section and said tape career of said film 7 are pasted up, and there are some which established the cavity 6 in the interior (refer to JP,10-125825,A).

[0011] Moreover, there are some which established the cavity in the interior not only with the electronic instrument using said SAW filter component but with the semiconductor device using the semiconductor chip which carries out high frequency actuation of GaAsFET (Field Effect Transistor) etc.

[0012] In the semiconductor device using semiconductor chips, such as said GaAsFET, if between said semiconductor chips and said tape careers is closed by under-filling material after carrying out flip chip mounting of said semiconductor chip on said tape career, signal delay etc. will occur with the dielectric constant of said under-filling material, and a property will deteriorate. therefore -- for example, as shown in drawing 8 , the semiconductor device which carried out flip chip mounting of said semiconductor chip 8, connected said wiring 2 with the external terminal 801 of said semiconductor chip by the conductive member 4, formed thermosetting resin 9 only at the periphery section of said semiconductor chip 8 on the tape career by which wiring 2 was formed in the front face of an insulating substrate 1, and formed the cavity 6 between said tape careers and semiconductor chips 8 is proposed (refer to JP,2000-164635,A).

[0013] In a semiconductor device as shown in said drawing 8 , since the circuit

forming face 8A top of said semiconductor chip 8 is a cavity 6, also when carrying out high frequency operation, signal delay etc. cannot occur easily, and degradation of a property can be prevented.

[0014]

[Problem(s) to be Solved by the Invention] However, in said Prior art, when a cavity 6 is established in the interior of said electronic instrument, with heating at the time of mounting said electronic instrument in a mounting substrate (soldering) etc., the air in said equipment expands and an internal (centrum) atmospheric pressure rises.

[0015] With the equipment closed using [at this time 7, for example a film for the closures which was indicated by said JP,10-125825,A,], although the pressure of a cavity 6 could be lowered because said film 7 for the closures expands as shown in drawing 7 , by expanding, the load was applied to said film 7 for the closures, and there was a problem of separating from said SAW filter component 3 and tape career.

[0016] Moreover, when were carried out like the semiconductor device indicated by said JP,2000-164635,A, and the air of a centrum (cavity 6) expanded, the connection of wiring 2 and a conductive member 4 or the connection of the external terminal 801 of a semiconductor chip and a conductive member 4 separated, and there was a problem of becoming a faulty connection.

[0017] Moreover, since said cavity 6 and exterior of equipment were intercepted with the insulator for the closures in the case of the electronic instrument (semiconductor device) shown in drawing 7 and drawing 8 , there was a problem that the defective continuity by the moisture for which said cavity 6 and said closure ingredient absorbed moisture tends to happen.

[0018] Moreover, in the case of the electronic instrument using the film 7 for the closures as shown in drawing 7 , dispersion arises in the appearance configuration of said electronic instrument according to deformation of said film 7 for the closures. Moreover, in order said film 7 for the closures is thin and to tend to tear it, there was a problem that the handling at the time of mounting etc. was

difficult.

[0019] Moreover, although said thermosetting resin 9 will spread when said semiconductor chip 8 is mounted if it carries out like the semiconductor device indicated by said JP,2000-164635,A for example, control of the amount of breadth is difficult. Therefore, there was a problem of having been easy to produce dispersion for the volume of said cavity, and being easy to produce dispersion in an operating characteristic for every semiconductor device.

[0020] The purpose of this invention is in the electronic instrument which established the cavity in the interior to offer the technique which can control the rise of the pressure of the cavernous section by expansion of the steam in a cavity. Other purposes of this invention are in the electronic instrument which established the cavity in the interior to offer the technique which can raise thermal shock resistance. Other purposes of this invention are in the electronic instrument which established the cavity in the interior to offer the technique which can prevent the defective continuity by the steam in a cavity. Other purposes of this invention are in the electronic instrument which established the cavity in the interior to offer the technique which can make control of the volume of the cavernous section easy. Other purposes of this invention are in the electronic instrument which established the cavity in the interior to offer the technique in which the miniaturization of equipment and lightweight-izing are possible. As new along [said] this invention a description as the other purposes will become clear by description and the accompanying drawing of this specification.

[0021]

[Means for Solving the Problem] It will be as follows if the outline of invention indicated in this application is explained.

(1) The wiring substrate with which wiring (conductor pattern) was prepared on the surface of the insulating substrate, The conductive member which connects the chip-like component prepared on said wiring substrate, the external terminal of said chip-like component, and wiring of said wiring substrate, It is the electronic instrument which consists of a closure member which closes the

perimeter of said chip-like component, and has a cavity between said wiring substrate and said chip-like component. Said closure member Consisting of a steam transparency member which penetrates a steam, and a cap member which is hard to penetrate or it does not penetrate a steam, said steam transparency member is an electronic instrument which is opening the exterior of said closure member for free passage in said cavity.

[0022] According to the means of the above (1), the steam in said cavity (air) can be emitted to said closure member to the exterior of said electronic instrument through said steam transparency member by having prepared said steam transparency member. Therefore, it can control that the steam in said cavity expands with heating etc., and the pressure in said cavity rises for example.

[0023] At this time, said closure member can carry out direct continuation of said external terminal and said wiring by the metal junction using said current-carrying-part agent by preparing the crevice which has larger space than the volume of said chip-like component, and preparing said chip-like component in the space surrounded in the crevice of said wiring substrate and said closure member. Therefore, the connection resilience of said external terminal and said wiring is high, and the electronic instrument which cannot separate easily can be obtained.

[0024] Moreover, in order to prepare said chip-like component in the cavity surrounded in the crevice of said wiring substrate and said closure member, there is no closure ingredient between said chip-like components and said wiring substrates. Therefore, compared with the electronic instrument which closed the perimeter of said chip-like component with the insulator, dispersion in an operating characteristic can be reduced like before.

[0025] Moreover, it is possible at this time to thin-shape-ize an electronic instrument by preparing the steam transparency member of the shape of said film between said wiring substrates and said cap members, using a film-like member as said steam transparency member. Moreover, compared with the conventional ceramic package, lightweight-ization is attained by using the

ingredient of the shape of said film.

[0026] Moreover, in the means of the above (1), it is desirable to prepare as said chip-like component, for example using the surface acoustic element in which the blind-like electrode (tandem-type electrode) was prepared on the surface of piezoelectric material, so that said blind-like electrode and said wiring substrate may face each other. Since said surface acoustic element is prepared in the cavity surrounded with said closure member and said wiring substrate at this time, a cavity is made on all over the field in which said blind-like electrode was formed, and it can prevent the property of said surface acoustic element deteriorating.

[0027] (2) The chip-like component mounting process of arranging a chip-like component on the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after said chip-like component mounting process. The steam permeability film with which the field which arranges said chip-like component carried out opening of said wiring substrate is formed. Said closure process It is the manufacture approach of an electronic instrument of putting the cap member which is hard to penetrate or it does not penetrate a steam, and pasting up said cap member and said wiring substrate through said steam permeability film on said chip-like component.

[0028] According to the means of the above (2), a cavity can be easily prepared between said chip-like components and said wiring substrates by mounting said chip-like component in opening formed in said steam permeability film using the wiring substrate with which said steam permeability film was formed, and putting and closing said cap member.

[0029] Moreover, also after putting and closing said cap member by forming said steam permeability film on said wiring substrate, the steam in the cavity of said

electronic instrument can be emitted to the exterior of said electronic instrument through said steam permeability film. Therefore, at the time of heating of said electronic instrument etc., the steam in said cavity (air) can expand, it can prevent said wiring substrate's separating or the connection of said wiring and said external terminal separating, and an electronic instrument with high thermal shock resistance can be obtained.

[0030] Moreover, in order to form so that said steam permeability film and said cap member may cover the outside of said chip-like component at this time, there is no closure member between said chip-like components and said wiring substrates. That is, since the whole surface of the field which faces said wiring substrate is exposed, said chip-like component can prevent dispersion arising in the operating characteristic for every electronic instrument by dispersion in the volume of a cavity.

[0031] (3) The chip-like component mounting process of arranging a chip-like component on the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after said chip-like component mounting process. The film adhesion process of pasting up the steam permeability film with which the field which arranges said chip-like component on said wiring substrate carried out opening of said chip-like component mounting process, A chip-like component is arranged on said wiring substrate, and it has the chip connection process of connecting wiring of said wiring substrate, and the external terminal of said chip-like component. Said closure process It is the manufacture approach of an electronic instrument of putting the cap member which is hard to penetrate or it does not penetrate a steam, and pasting up said cap member and said wiring substrate through said steam permeability film on said chip-like component.

[0032] In said chip-like component mounting process, by establishing said film adhesion process and said chip connection process, said chip-like component can be mounted in opening formed in said steam permeability film, and, according to the means of the above (3), a cavity can be easily prepared between said chip-like components and said wiring substrates by putting and closing said cap member.

[0033] Moreover, also after putting and closing said cap member by establishing said film adhesion process and said chip connection process, the steam in the cavity of said electronic instrument can be emitted to the exterior of said electronic instrument through said steam permeability film. Therefore, at the time of heating of said electronic instrument etc., the steam in said cavity (air) can expand, it can prevent said wiring substrate's separating or the connection of said wiring and said external terminal separating, and an electronic instrument with high thermal shock resistance can be obtained.

[0034] Moreover, in order to form so that said steam permeability film and said cap member may cover the outside of said chip-like component at this time, there is no closure member between said chip-like components and said wiring substrates. That is, since the whole surface of the field which faces said wiring substrate is exposed, said chip-like component can prevent dispersion arising in the operating characteristic for every electronic instrument by dispersion in the volume of a cavity.

[0035] (4) The wiring substrate formation process which forms the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, The chip-like component mounting process of arranging a chip-like component on the wiring substrate formed with said wiring substrate formation process, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after said chip-like component

mounting process. The wiring formation process with which said wiring substrate formation process forms said wiring in the front face of said insulating substrate, It has the film adhesion process of pasting up the steam permeability film in which the field which arranges said chip-like component carried out opening, on said insulating substrate after said wiring formation process. Said closure process It is the manufacture approach of an electronic instrument of putting the cap member which is hard to penetrate or it does not penetrate a steam, and pasting up said cap member and said wiring substrate through said steam permeability film on said chip-like component.

[0036] In said wiring substrate formation process, by establishing said wiring formation process and said film adhesion process, said chip-like component can be mounted in opening formed in said steam permeability film, and, according to the means of the above (4), a cavity can be easily prepared between said chip-like components and said wiring substrates by putting and closing said cap member.

[0037] Moreover, also after putting and closing said cap member by establishing said film adhesion process, the steam in the cavity of said electronic instrument can be emitted to the exterior of said electronic instrument through said steam permeability film. Therefore, at the time of heating of said electronic instrument etc., the steam in said cavity (air) can expand, it can prevent said wiring substrate's separating or the connection of said wiring and said external terminal separating, and an electronic instrument with high thermal shock resistance can be obtained.

[0038] Moreover, in order to form so that said steam permeability film and said cap member may cover the outside of said chip-like component at this time, there is no closure member between said chip-like components and said wiring substrates. That is, since the whole surface of the field which faces said wiring substrate is exposed, said chip-like component can prevent dispersion arising in the operating characteristic for every electronic instrument by dispersion in the volume of a cavity.

[0039] (5) The chip-like component mounting process of arranging a chip-like component on the wiring substrate with which wiring (conductor pattern) was formed on the surface of the insulating substrate, and connecting wiring of said wiring substrate, and the external terminal of said chip-like component, It is the manufacture approach of an electronic instrument equipped with the closure process which closes the perimeter of said chip-like component so that a cavity may be made between said wiring substrate and said chip-like component after said chip-like component mounting process. The steam permeability member to which said closure process penetrates a steam on the wiring substrate with which said chip-like component was mounted, It is the manufacture approach of the electronic instrument which consists of a cap member which is hard to penetrate or it does not penetrate a steam, puts the closure member in which the crevice which has larger space than the volume of said chip-like component was formed, and pastes up and closes said closure member and said wiring substrate.
[0040] The steam permeability member which penetrates a steam in said closure process on the wiring substrate with which said chip-like component was mounted according to the means of the above (5), It consists of a cap member which is hard to penetrate or it does not penetrate a steam, and a cavity can be easily prepared between said chip-like components and said wiring substrates by putting and closing the closure member in which the crevice which has larger space than the volume of said chip-like component was formed.
[0041] Moreover, also after putting and closing said closure member by preparing said steam permeability member in said closure member, the steam in the cavity of said electronic instrument can be emitted to the exterior of said electronic instrument through said steam permeability member. Therefore, at the time of heating of said electronic instrument etc., the steam in said cavity (air) can expand, it can prevent said wiring substrate's separating or the connection of said wiring and said external terminal separating, and an electronic instrument with high thermal shock resistance can be obtained.
[0042] Moreover, in order to form so that said steam permeability member and

said cap member may cover the outside of said chip-like component at this time, there is no closure member between said chip-like components and said wiring substrates. That is, since the whole surface of the field which faces said wiring substrate is exposed, said chip-like component can prevent dispersion arising in the operating characteristic for every electronic instrument by dispersion in the volume of a cavity.

[0043] Moreover, it is desirable to prepare so that said blind-like electrode and said wiring substrate may face each other in the means of the above (5) using the surface acoustic element in which the blind-like electrode (tandem-type electrode) was prepared on the surface of piezoelectric material as said chip-like component mounting process, for example from the means of the above (2). Since said surface acoustic element is prepared in the cavity surrounded with said closure member and said wiring substrate at this time, a cavity is made on all over the field in which said blind-like electrode was formed, and it can prevent the property of said surface acoustic element deteriorating.

[0044] (6) When a chip-like component is prepared in the field in which the insulating closure ingredient is prepared on the wiring substrate with which wiring (conductor pattern) was prepared on the surface of the insulating substrate, and said closure ingredient on said wiring substrate was prepared It is said wiring substrate and the wiring substrate with which a cavity is prepared between said chip-like components and which is used for manufacture of an electronic instrument, and said closure ingredient is a steam permeability film which penetrates a steam, and is a wiring substrate in which the field in which said chip-like component is prepared is carrying out opening.

[0045] When according to the means of the above (6) said chip-like component is prepared on said wiring substrate and the perimeter of said chip-like component is closed by preparing said steam permeability film on said wiring substrate, a cavity can be easily prepared between said wiring substrate and said chip-like component.

[0046] Moreover, also after closing the perimeter of said chip-like component, the

steam in said cavity can be emitted outside through said steam permeability film. Therefore, by using said wiring substrate, the steam in said cavity (air) can expand, it can prevent said wiring substrate's separating or the connection of said wiring and said external terminal separating, and an electronic instrument with high thermal shock resistance can be manufactured.

[0047] (7) It is the closure member which closes the chip-like component mounted on the wiring substrate, and is the closure member in which the crevice which serves as a steam permeability member which penetrates a steam from the cap section which is hard to penetrate or it does not penetrate a steam, and has larger space than the volume of said chip-like component is established.

[0048] In case the perimeter of the chip-like component mounted in said closure member on the wiring substrate by preparing the crevice which has larger space than the volume of said chip-like component is closed according to the means of the above (7), a cavity can be easily prepared between said chip-like components and said wiring substrates.

[0049] Moreover, also after closing the perimeter of said chip-like component using said closure member, the steam in said cavity can be emitted outside through said steam permeability film. Therefore, by using said closure member, the steam in said cavity (air) can expand, it can prevent said wiring substrate's separating or the connection of said wiring and said external terminal separating, and an electronic instrument with high thermal shock resistance can be manufactured.

[0050] Moreover, at this time, said steam permeability member is a film-like, by being prepared in the effective area side of said crevice of said cap section, can thin-shape-ize said closure member, and can manufacture a thin electronic instrument.

[0051] Hereafter, this invention is explained to a detail with the gestalt (example) of operation with reference to a drawing. In addition, in the complete diagram for explaining an example, what has the same function attaches the same sign, and explanation of the repeat is omitted.

[0052]

[Embodiment of the Invention] (Example 1) Drawing 1 is the mimetic diagram showing the outline configuration of the electronic instrument of the example 1 by this invention, and it is a sectional view in the A-A' line of the electronic instrument which showed drawing 1 (a) in the top view of an electronic instrument, and showed drawing 1 (b) to drawing 1 (a).

[0053] In drawing 1 (a) and drawing 1 (b) in 1, an insulating substrate and 2 wiring and 201 the 1st conductor The film, 202 copper plating (beer) and 204 for the film (external terminal) and 203 the 2nd conductor Terminal plating, 3 -- a chip-like component (surface acoustic wave filter element) and 301 -- a piezo-electric substrate and 302 -- for a closure member and 5A, as for a steam permeability film and 502, the crevice of a closure member and 501 are [a blind-like electrode and 4 / a conductive member (golden bump) and 5 / a cap member and 6] cavities.

[0054] The wiring substrate with which the wiring 2 of a predetermined pattern was formed in the front face of an insulating substrate 1 as the electronic instrument of this example 1 was shown in drawing 1 , The conductive member 4 which connects the chip-like component 3 prepared on said wiring substrate, the external terminal of said chip-like component 3, and the wiring 2 of said wiring substrate, It consists of a closure member 5 which closes the perimeter of said chip-like component 3, and the cavity 6 is formed between said wiring substrate (insulating substrate 1) and said chip-like component 3.

[0055] The field which is said insulating substrate 1 and in which in other words said chip-like component 3 was formed the 1st principal plane said wiring 2 the 1st conductor Moreover, the film 201, it was prepared in the rear face (the 2nd principal plane) of the 1st principal plane of said insulating substrate 1 -- with the film 202 the 2nd conductor opening (beer hole) 1A prepared in said insulating substrate 1 -- letting it pass -- said -- it consists of the film 201, said copper plating 203 which connects the film 202 electrically the 2nd conductor, and said terminal plating 204 formed in the front face of the film 202 and said copper

plating 203 the 2nd conductor the 1st conductor. Although illustration is omitted at this time, said terminal plating 204 consists of gilding which made nickel plating the substrate.

[0056] Moreover, in the electronic instrument of this example 1, said chip-like component 3 is a surface acoustic wave filter element by which the blind-like electrode 302 was formed in the front face of the piezo-electric substrate 301, and it is prepared so that said blind-like electrode 302 may face said wiring substrate (insulating substrate 1). At this time, terminal plating (gilding) 204 of the front face of the golden bump 4 and said wiring 2 is considered as **** junction at the conductive member 4 which connects the wiring 2 of said wiring substrate with said blind-like electrode 302 using a golden bump.

[0057] Moreover, said closure member 5 consists of a cap member 502 which is hard to penetrate or said closure member 5 does not penetrate the steam permeability film 501 which penetrates a steam, and a steam, and crevice 5A which has larger space than the volume of said chip-like component 3 is prepared. Therefore, said chip-like component 3 is formed in the cavity 6 surrounded by crevice 5A of said wiring substrate (insulating substrate 1) and said closure member. Moreover, said steam permeability film 501 is opening said cavity 6 and exterior of said closure member 5 for free passage at this time.

[0058] According to the electronic instrument of this example 1, the steam in said cavity 6 (air) can be emitted to said closure member 5 to the exterior of said electronic instrument through said steam transparency film by having formed said steam transparency film 501. Therefore, it can control that the steam of said cavity 6 expands with heating etc., and the pressure of said cavity 6 rises for example.

[0059] At this time, as said closure member 5 was shown in drawing 1 (a) and drawing 1 (b) By preparing crevice 5A of the larger volume than the volume of said chip-like component 3, and forming said chip-like component 3 in the cavity 6 surrounded by crevice 5A of said wiring substrate and said closure member 5 Direct continuation of the blind-like electrode 302 of said surface acoustic wave

filter element 3 and the wiring 2 (gilding 204) of said wiring substrate can be carried out by the **** junction using said golden bump 4. Therefore, the connection resilience of said blind-like electrode 302 and said wiring 2 is high, and the electronic instrument which cannot separate easily can be obtained.

[0060] Moreover, since it can let said steam permeability film 501 pass and the moisture of said cavity 6 can be emitted to the exterior of equipment, the defective continuity by the moisture in a cavity 6 can be prevented.

[0061] Moreover, it is possible at this time to thin-shape-ize an electronic instrument by pasting up said wiring substrate and said cap member 502 through said steam permeability film 501. Moreover, compared with the conventional ceramic package, lightweight-ization is attained by using said wiring substrate, said steam permeability film 501, and said cap member 502.

[0062] Moreover, as for the field which faces said wiring substrate of said surface acoustic wave filter element 3, the whole surface becomes a cavity by forming said surface acoustic wave filter element 3 in the cavity 6 surrounded by crevice 5A of said wiring substrate and said closure member. Therefore, compared with the semiconductor device which closed the perimeter with the thermosetting resin of the former as shown in said drawing 8 , control of the volume of said cavity 6 is easy, and it can prevent dispersion in an operating characteristic arising for every electronic instrument.

[0063] Drawing 2 and drawing 3 are the mimetic diagrams for explaining the manufacture approach of the electronic instrument of this example 1, and it is the sectional view of each process which the sectional view of each process in which drawing 2 (a), drawing 2 (b), drawing 2 (c), and drawing 2 (d) form a wiring substrate, drawing 3 (a), and drawing 3 (b) mount a chip-like component, and manufactures an electronic instrument.

[0064] Hereafter, although the manufacture approach of the electronic instrument of this example 1 is explained along with drawing 2 and drawing 3 , the detailed explanation is omitted about the same process as the conventional manufacture approach.

[0065] First, as shown in drawing 2 (a), opening (beer hole) 1A is formed in both sides of an insulating substrate 1 the 1st conductor in the predetermined location of the film 201 and the double-sided copper-clad sheet with which the film 202 was formed the 2nd conductor. said insulating substrate 1 -- for example, a polyimide tape, a glass fabric base material epoxy resin laminated sheet, etc. -- using -- said 1st conductor -- the film 201 -- and -- said -- electrolytic copper foil and rolling copper foil are used for the film 202 the 2nd conductor. Moreover, said opening 1A is formed by laser etching which used carbon dioxide gas laser, excimer laser, etc.

[0066] next, it is shown in drawing 2 (b) -- as -- said -- copper plating 203 is formed in the whole surface surface of the film 201, and the interior of said opening 1A the 1st conductor. Said copper plating 203 is formed for example, with electrolytic copper plating.

[0067] next, as shown in drawing 2 (c), the laminating of said copper plating 203 was carried out -- the 1st conductor, the film 201 and after [said] carrying out etching processing of the film 202 the 2nd conductor and forming the wiring 2 of a predetermined pattern, the terminal plating 204 is formed in the front face of said wiring 2. At this time, said terminal plating 204 plates with gold and forms it, using nickel plating as a substrate.

[0068] Next, as shown in drawing 2 (d), the steam permeability film 501 in which the field which arranges said chip-like component 3 carried out opening is stuck on the field which mounts the chip-like component 3 of the insulating substrate 1 in which said wiring 2 was formed. PTFE (polytetrafluoroethylene) of fizz is used for said steam permeability film 501 at this time. Moreover, although illustration is omitted, the binder layer is prepared in both sides of said steam permeability film 501.

[0069] Next, as shown in drawing 3 (a), the surface acoustic wave filter element 3 is arranged inside opening 501A of said steam permeability film 501, and the wiring 2 on said insulating substrate 1 is electrically connected with the blind-like electrode (wiring) 302 of said surface acoustic wave filter element 3. At this time,

the golden bump (conductive member) 4 is formed in a part for the terminal area of said blind-like electrode 302, and **** junction of said golden bump 4 and terminal plating 204 of said wiring 2 is carried out by the thermocompression bonding which used the supersonic wave together.

[0070] Next, as shown in drawing 3 (b), the cap member 502 by which crevice 502B of the predetermined depth was prepared on said surface acoustic wave filter element 3 is put, said cap member 502 and said steam permeability film 501 are pasted up, said surface acoustic wave filter element 3 is closed, and if it cuts and piece[of an individual]-izes with a predetermined cutting plane line, an electronic instrument as shown in drawing 1 (a) and drawing 1 (b) can be obtained. At this time, a metallic material like 42 alloys is used as said cap member, for example.

[0071] The electronic instrument (SAW filter equipment) formed in said procedure solders wiring of said mounting substrate, and the wiring 2 (external terminal 202) of said electronic instrument, when it is used as a band pass filter of mobile communication equipment, such as a cellular phone, and being mounted on a mounting substrate. Therefore, although said electronic instrument is heated in the case of said soldering and the steam (air) of said cavity 6 expands, the steam which expanded is emitted to the exterior of said electronic instrument through said steam permeability film 501, and it can control that the pressure of said cavity 6 rises.

[0072] Moreover, since it can control that the pressure of said cavity 6 rises with heating of said electronic instrument, the fall of the dependability of the equipment by peeling of said wiring substrate etc. can be prevented.

[0073] As explained above, according to the electronic instrument of this example 1, it can control that can emit said steam to the exterior of an electronic instrument, and the pressure of a cavity 6 rises to it when the steam (air) of a cavity 6 expands with heating etc. by forming the steam permeability film 501 to the closure member 5 which closes said chip-like component (surface acoustic wave filter element) 3.

[0074] Moreover, since it can control that the pressure of said cavity 6 rises with heating of said electronic instrument, the fall of the dependability of the equipment by peeling of said wiring substrate etc. can be prevented.
[0075] Moreover, direct continuation of the blind-like electrode 302 of said surface acoustic wave filter element 3 and the wiring 2 (gilding 204) of said wiring substrate can be carried out by the **** junction using said golden bump 4 by preparing crevice 5A of the larger volume than the volume of said chip-like component 3 in said closure member 5, and forming said chip-like component 3 in the cavity 6 surrounded by crevice 5A of said wiring substrate and said closure member 5. Therefore, the connection resilience of said blind-like electrode 302 and said wiring 2 is high, and the electronic instrument which cannot separate easily can be obtained.
[0076] Moreover, compared with the conventional ceramic package, lightweight-ization is attained by pasting up said wiring substrate and said cap member 502 through said steam permeability film 501. Moreover, compared with said ceramic package, thin shape-ization of equipment is attained by making thin thickness of the part on said surface acoustic wave filter element 3 of said cap member 502, or narrowing the clearance between said cap members 502 and said surface acoustic wave filter elements 3.
[0077] Moreover, as for the field which faces said wiring substrate of said surface acoustic wave filter element 3, the whole surface becomes a cavity by forming said surface acoustic wave filter element 3 in the cavity 6 surrounded by crevice 5A of said wiring substrate and said closure member. Therefore, like the semiconductor device shown in said conventional drawing 8 , compared with the case where a perimeter is closed with thermosetting resin, control of the volume of said cavity 6 is easy, and it can prevent dispersion in an operating characteristic arising for every electronic instrument.
[0078] (Example 2) Drawing 4 thru/or drawing 6 are the mimetic diagrams for explaining the manufacture approach of the electronic instrument of the example 2 by this invention, and the sectional view of a process in which drawing 4 (a),

drawing 4 (b), and drawing 4 (c) form a wiring substrate, the sectional view of a process where drawing 5 (a) mounts a chip-like component, and drawing 5 (b) are the sectional view of a closure member, and the sectional view of the process which drawing 6 closes.

[0079] The manufacture approaches of the electronic instrument of this example 2 are other manufacture approaches of the electronic instrument shown in drawing 1 (a) and drawing 1 (b) which were explained in said example 1. Hereafter, although the manufacture approach of the electronic instrument of this example 2 is explained along with drawing 4 thru/or drawing 6 , the detailed explanation is omitted about the same process as the conventional manufacture approach.

[0080] First, as shown in drawing 4 (a), opening (beer hole) 1A is formed in both sides of an insulating substrate 1 the 1st conductor in the predetermined location of the film 201 and the double-sided copper-clad sheet with which the film 202 was formed the 2nd conductor. said insulating substrate 1 -- for example, a polyimide tape, a glass fabric base material epoxy resin laminated sheet, etc. -- using -- said 1st conductor -- the film 201 -- and -- said -- electrolytic copper foil and rolling copper foil are used for the film 202 the 2nd conductor. Moreover, said opening 1A is formed by laser etching which used carbon dioxide gas laser, excimer laser, etc.

[0081] next, it is shown in drawing 4 (b) -- as -- said -- copper plating 203 is formed in the whole surface surface of the film 201, and the interior of said opening 1A the 1st conductor. Said copper plating 203 is formed for example, with electrolytic copper plating.

[0082] next, as shown in drawing 4 (c), the laminating of said copper plating 203 was carried out -- the 1st conductor, the film 201 and after [said] carrying out etching processing of the film 202 the 2nd conductor and forming the wiring 2 of a predetermined pattern, the terminal plating 204 is formed in the front face of said wiring 2. At this time, said terminal plating 204 plates with gold and forms it, using nickel plating as a substrate.

[0083] Next, as shown in drawing 5 (a), the wiring 2 on said insulating substrate 1 is electrically connected with the blind-like electrode (tandem-type electrode) 302 of said surface acoustic wave filter element 3. At this time, the golden bump (conductive member) 4 is formed in a part for the terminal area of said blind-like electrode 302, and **** junction of said golden bump 4 and terminal plating 204 of said wiring 2 is carried out by the thermocompression bonding which used the supersonic wave together.

[0084] Next, as shown in drawing 5 (b), the closure member 5 in which crevice 5A which has larger space than the volume of said surface acoustic wave filter element 3 was formed is prepared for the cap member 502 which stuck the steam permeability film 501. At this time 501, for example, said steam permeability film, 42 alloys are used for said cap member 502 using PTFE of fizz. Moreover, although illustration is omitted, the adhesives layer is prepared in the front face of said steam permeability film 501.

[0085] Next, as shown in drawing 6 , said closure member 5 is put on said surface acoustic wave filter element 3, said wiring substrate (insulating substrate 1) and said steam permeability film 501 are pasted up, said surface acoustic wave filter element 3 is closed, and if it cuts and piece[of an individual]-izes with a predetermined cutting plane line, an electronic instrument as shown in drawing 1 (a) and drawing 1 (b) can be obtained.

[0086] The electronic instrument (SAW filter equipment) formed in said procedure solders wiring of said mounting substrate, and the wiring 2 (external terminal 202) of said electronic instrument, when it is used as a band pass filter of mobile communication equipment, such as a cellular phone, and being mounted on a mounting substrate. Therefore, although said electronic instrument is heated in the case of said soldering and the steam (air) of said cavity 6 expands, the steam which expanded is emitted to the exterior of said electronic instrument through said steam permeability film 501, and it can control that the pressure of said cavity 6 rises.

[0087] Moreover, since it can control that the pressure of said cavity 6 rises with

heating of said electronic instrument, the fall of the dependability of the equipment by peeling of said wiring substrate etc. can be prevented.

[0088] As explained above, according to the manufacture approach of the electronic instrument of this example 2, it can control that can emit said steam to the exterior of an electronic instrument, and the pressure of a cavity 6 rises to it when the steam (air) of a cavity 6 expands with heating etc. by forming the steam permeability film 501 to the closure member 5 which closes said chip-like component (surface acoustic wave filter element) 3.

[0089] Moreover, since it can control that the pressure of said cavity 6 rises with heating of said electronic instrument, the fall of the dependability of the equipment by peeling of said wiring substrate etc. can be prevented.

[0090] Moreover, direct continuation of the blind-like electrode 302 of said surface acoustic wave filter element 3 and the wiring 2 (gilding 204) of said wiring substrate can be carried out by the **** junction using said golden bump 4 by preparing crevice 5A of the larger volume than the volume of said chip-like component 3 in said closure member 5, and forming said chip-like component 3 in the cavity 6 surrounded by crevice 5A of said wiring substrate and said closure member 5. Therefore, the connection resilience of said blind-like electrode 302 and said wiring 2 is high, and the electronic instrument which cannot separate easily can be obtained.

[0091] Moreover, since it can let said steam permeability film 501 pass and the moisture of said cavity 6 can be emitted to the exterior of equipment, the defective continuity by the moisture in a cavity 6 can be prevented.

[0092] Moreover, compared with the conventional ceramic package, lightweight-ization is attained by pasting up said wiring substrate and said cap member 502 through said steam permeability film 501 using said steam permeability film 501. Moreover, compared with said ceramic package, thin shape-ization of equipment is attained by making thin thickness of the part on said surface acoustic wave filter element 3 of said cap member 502, or narrowing the clearance between said cap members 502 and said surface acoustic wave filter elements 3.

[0093] Moreover, as for the field which faces said wiring substrate of said surface acoustic wave filter element 3, the whole surface becomes a cavity by forming said surface acoustic wave filter element 3 in the cavity 6 surrounded by crevice 5A of said wiring substrate and said closure member. Therefore, like the semiconductor device shown in said conventional drawing 8 , compared with the case where a perimeter is closed with thermosetting resin, control of the volume of said cavity 6 is easy, and it can prevent dispersion in an operating characteristic arising for every electronic instrument.

[0094] As mentioned above, although this invention was concretely explained based on said example, as for this invention, it is needless to say for it to be able to change variously in the range which is not limited to said example and does not deviate from the summary.

[0095] For example, in said example 1 and said example 2, as said cap member 502, although 42 alloys were used, not only this but other metallic materials and insulating materials, such as thermosetting resin, may be used.

[0096] Moreover, although said example 1 and said example 2 explained the electronic instrument using the surface acoustic wave filter element by which the blind-like electrode (tandem-type electrode) 302 was formed in the front face of the piezo-electric substrate 301, and its manufacture approach as said chip-like component 3, not only this but the surface acoustic element used as a resonator (radiator) may be used. Moreover, said chip-like component 3 may be applied to the semiconductor device not only using said surface acoustic element but the semiconductor chip which carries out high frequency actuation like GaAsFET (Field Effect Transistor).

[0097] In the semiconductor chip which carries out said high frequency actuation, if the closure of a circuit forming face, i.e., the field in which the external terminal was formed, is carried out by insulating resin, the signal delay by the dielectric constant of closure resin etc. will occur, and a high frequency property will deteriorate. Therefore, by making it a configuration as shown in drawing 1 (b), a cavity 6 is made on the circuit forming face of said semiconductor chip, and

degradation of a RF property can be prevented.

[0098]

[Effect of the Invention] It will be as follows if the effectiveness acquired by the typical thing among invention indicated in this application is explained briefly.

(1) In the electronic instrument which established the cavity in the interior, the rise of the pressure of the cavernous section by expansion of the steam in a cavity can be controlled.

(2) Thermal shock resistance can be raised in the electronic instrument which established the cavity in the interior.

(3) In the electronic instrument which established the cavity in the interior, the defective continuity by the steam in a cavity can be prevented.

(4) In the electronic instrument which established the cavity in the interior, control of the volume of the cavernous section can be made easy.

(5) It sets to the electronic instrument which established the cavity in the interior, and it miniaturizes and-izing of the equipment can be carried out [lightweight].

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the mimetic diagram showing the outline configuration of the electronic instrument of the example 1 by this invention, and drawing 1 (a) is the top view of an electronic instrument, and drawing 1 R> 1 (b) is a sectional view in the A-A' line of drawing 1 (a).

[Drawing 2] It is a mimetic diagram for explaining the manufacture approach of the electronic instrument of this example 1, and the sectional view of each process which forms wiring, and drawing 2 R> 2 (d) of drawing 2 (a), drawing 2 (b), and drawing 2 (c) are sectional views of a process on which a steam permeability film is pasted up, respectively.

[Drawing 3] It is a mimetic diagram for explaining the manufacture approach of the electronic instrument of this example 1, and the sectional view of a process where drawing 3 (a) mounts a chip-like component, and drawing 3 (b) are the sectional views of the process which closes a chip-like component.

[Drawing 4] It is a mimetic diagram for explaining the manufacture approach of the electronic instrument of the example 2 by this invention, and drawing 4 (a), drawing 4 (b), and drawing 4 (c) are the sectional views of each process which forms a wiring substrate, respectively.

[Drawing 5] It is a mimetic diagram for explaining the manufacture approach of the electronic instrument of this example 2, and the sectional view of a process where drawing 5 (a) mounts a chip-like component, and drawing 5 (b) are the sectional views showing the configuration of the closure member which closes a chip-like component.

[Drawing 6] It is a mimetic diagram for explaining the manufacture approach of the electronic instrument of this example 2, and is the sectional view of the process which closes a chip-like component.

[Drawing 7] It is the type section Fig. showing the outline configuration of the electronic instrument which has a cavity in the conventional interior.

[Drawing 8] It is the type section Fig. showing other outline configurations of the electronic instrument which has a cavity in the conventional interior.

[Description of Notations]

1 [-- The 1st conductor Film,] -- An insulating substrate, 1A -- Opening (beer hole), 2 -- Wiring, 201 202 -- It is the film and 203 the 2nd conductor. -- Copper plating (beer), 204 -- Terminal plating, 3 -- A chip-like component (surface acoustic wave filter element), 301 -- A piezo-electric substrate, 302 [-- A steam permeability film, 502 / -- A cap member, 6 / -- A cavity, 7 / -- The film for the closures, 8 / -- A semiconductor chip, 801 / -- 9 A bonding pad, 10 / -- Thermosetting resin.] -- A blind-like electrode (tandem-type electrode), 4 -- A conductive member (golden bump), 5 -- A closure member, 501

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

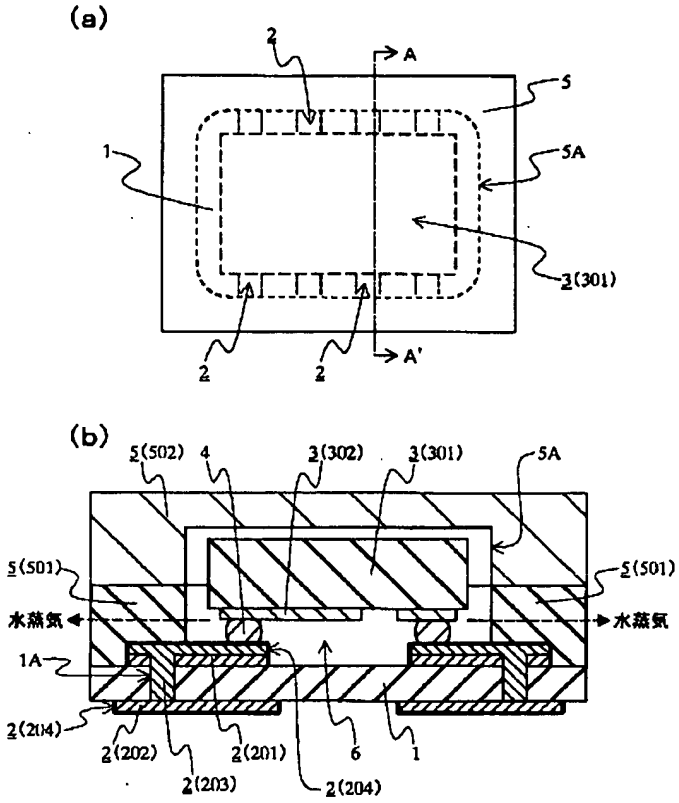
2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DRAWINGS

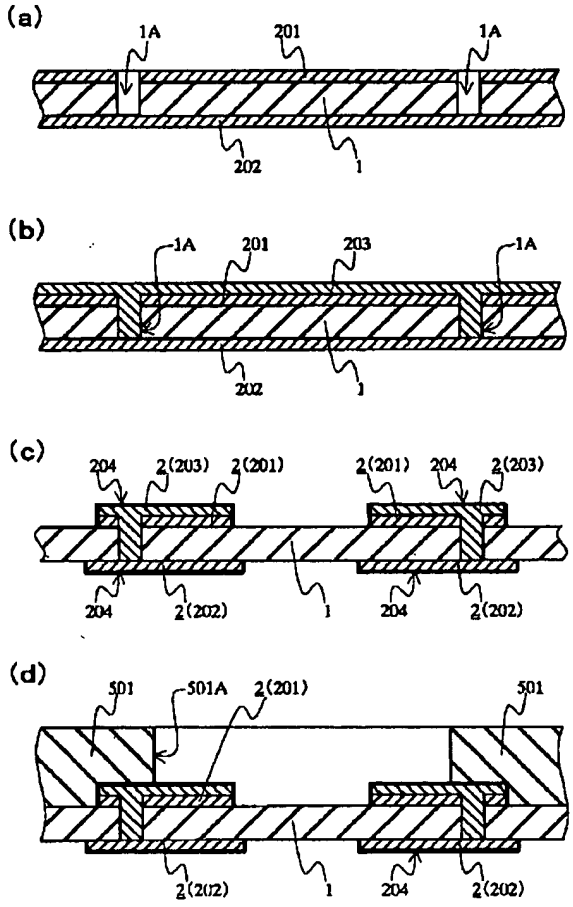
[Drawing 1]

図1



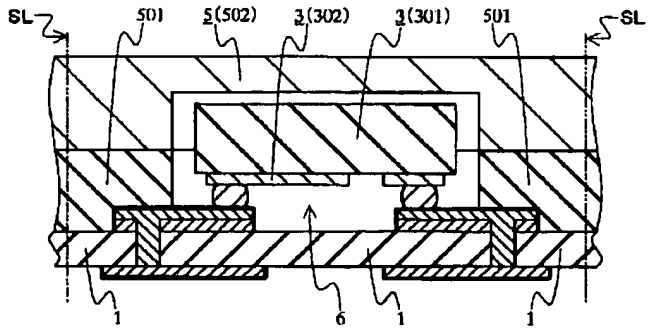
[Drawing 2]

図2



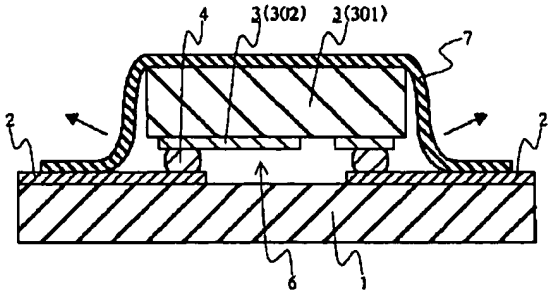
[Drawing 6]

図6



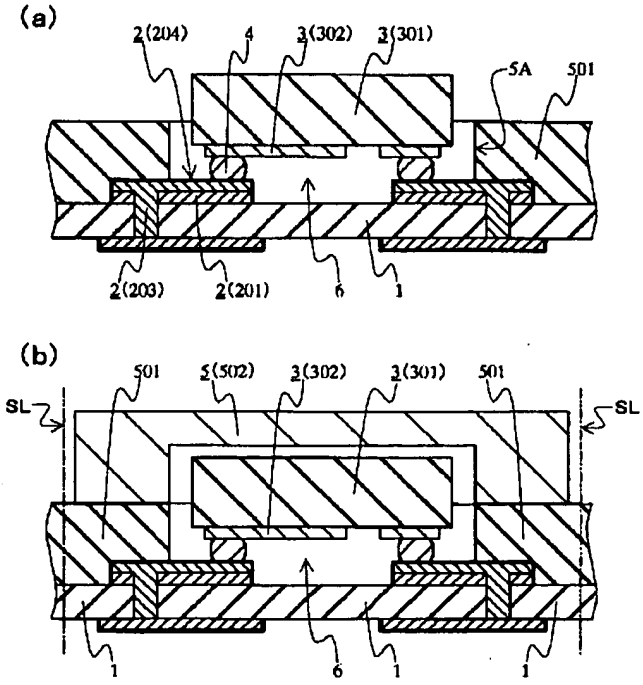
[Drawing 7]

図7



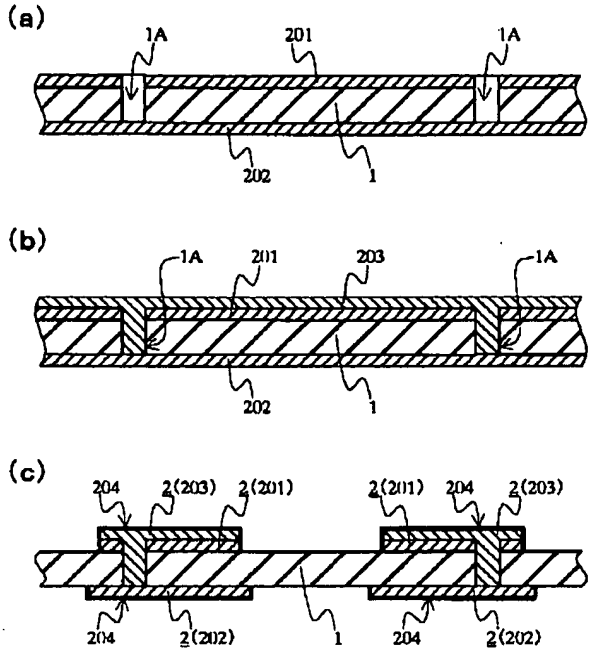
[Drawing 3]

図3



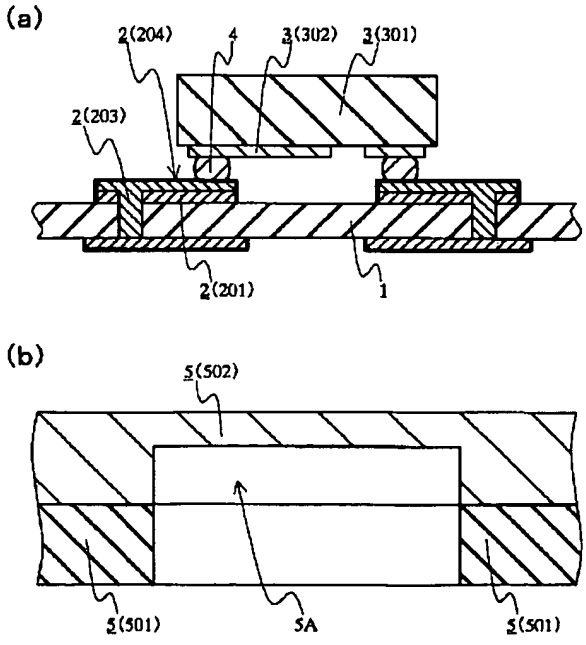
[Drawing 4]

図4



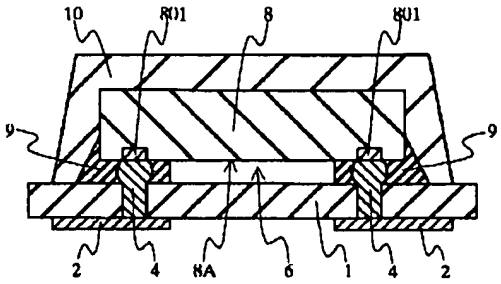
[Drawing 5]

図5



[Drawing 8]

図8



[Translation done.]

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9/25		9/25		Ａ

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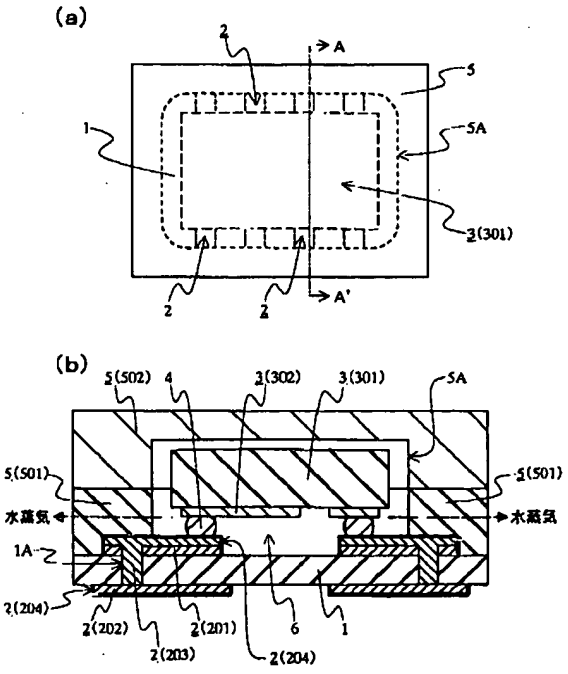
最終頁に続く

(54)【発明の名称】　電子装置及びその製造方法、ならびに電子装置の製造に用いる配線基板及び封止部材

(57)【要約】
【課題】　内部に空洞を設けた電子装置において、空洞内の水蒸気の膨張による、空洞部の圧力の上昇を抑制する。
【解決手段】　絶縁基板の表面に配線（導体パターン）が設けられた配線基板と、前記配線基板上に設けられたチップ状素子と、前記チップ状素子の外部端子と前記配線基板の配線とを接続する導電部材と、前記チップ状素子の周囲を封止する封止部材からなり、前記配線基板と前記チップ状素子との間に空洞を有する電子装置であって、前記封止部材は、水蒸気を透過する水蒸気透過部材と、水蒸気を透過しない若しくは透過しにくいキャップ部材からなり、前記水蒸気透過部材は、前記空洞内と前記封止部材の外部を連通している電子装置である。

図1



【特許請求の範囲】

【請求項１】　絶縁基板の表面に配線（導体パターン）が設けられた配線基板と、前記配線基板上に設けられたチップ状素子と、前記チップ状素子の外部端子と前記配線基板の配線とを接続する導電部材と、前記チップ状素子の周囲を封止する封止部材からなり、前記配線基板と前記チップ状素子との間に空洞を有する電子装置であって、

前記封止部材は、水蒸気を透過する水蒸気透過部材と、水蒸気を透過しない若しくは透過しにくいキャップ部材からなり、

前記水蒸気透過部材は、前記空洞内と前記封止部材の外部を連通していることを特徴とする電子装置。

【請求項２】　前記封止部材は、前記チップ状素子の体積よりも大きい空間を有する凹部が設けられており、前記チップ状素子は、前記配線基板と前記封止部材の凹部で囲まれた空洞内に設けられていることを特徴とする、請求項1に記載の電子装置。

【請求項３】　前記水蒸気透過部材はフィルム状であり、前記配線基板と前記キャップ部材の間に設けられていることを特徴とする、請求項１または請求項２に記載の電子装置。

【請求項４】　前記チップ状素子は、圧電材料の表面にすだれ状電極（櫛型電極）が設けられた弾性表面波素子であり、前記すだれ状電極と前記配線基板が向かい合うように設けられていることを特徴とする、請求項１乃至請求項３のいずれか１項に記載の電子装置。

【請求項５】　絶縁基板の表面に配線（導体パターン）が形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、

前記配線基板は、前記チップ状素子を配置する領域が開口した水蒸気透過性フィルムが形成されており、

前記封止工程は、

前記チップ状素子上に、水蒸気を透過しない若しくは透過しにくいキャップ部材をかぶせ、前記水蒸気透過性フィルムを介して前記キャップ部材と前記配線基板とを接着することを特徴とする電子装置の製造方法。

【請求項６】　絶縁基板の表面に配線（導体パターン）が形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、

前記チップ状素子実装工程は、

前記配線基板上に、前記チップ状素子を配置する領域が開口した水蒸気透過性フィルムを接着するフィルム接着工程と、

前記配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ接続工程とを備え、

前記封止工程は、

前記チップ状素子上に、水蒸気を透過しない若しくは透過しにくいキャップ部材をかぶせ、前記水蒸気透過性フィルムを介して前記キャップ部材と前記配線基板とを接着することを特徴とする電子装置の製造方法。

【請求項７】　絶縁基板の表面に配線（導体パターン）が形成された配線基板を形成する配線基板形成工程と、前記配線基板形成工程で形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、

前記配線基板形成工程は、

前記絶縁基板の表面に前記配線を形成する配線形成工程と、

前記配線形成工程の後、前記絶縁基板上に、前記チップ状素子を配置する領域が開口した水蒸気透過性フィルムを接着するフィルム接着工程とを備え、

前記封止工程は、

前記チップ状素子上に、水蒸気を透過しない若しくは透過しにくいキャップ部材をかぶせ、前記水蒸気透過性フィルムを介して前記キャップ部材と前記配線基板とを接着することを特徴とする電子装置の製造方法。

【請求項８】　絶縁基板の表面に配線（導体パターン）が形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、

前記封止工程は、

前記チップ状素子が実装された配線基板上に、

水蒸気を透過する水蒸気透過性部材と、水蒸気を透過しない若しくは透過しにくいキャップ部材とからなり、前記チップ状素子の体積よりも大きい空間を有する凹部が形成された封止部材をかぶせ、前記封止部材と前記配線基板とを接着して封止することを特徴とする電子装置の製造方法。

【請求項９】　前記チップ状素子実装工程は、

圧電材料の表面にすだれ状電極（櫛型電極）を形成した弾性表面波素子を、前記すだれ状電極が前記配線基板と向かい合うように配置することを特徴とする、請求項５乃至請求項８のいずれか１項に記載の電子装置の製造方

法。

【請求項１０】　絶縁基板の表面に配線（導体パターン）が設けられた配線基板上に、絶縁性の封止材料が設けられており、前記配線基板上の前記封止材料が設けられた面にチップ状素子を設けたときに、前記配線基板と前記チップ状素子の間に空洞が設けられる、電子装置の製造に用いる配線基板であって、

前記封止材料は、水蒸気を透過する水蒸気透過性フィルムであって、

前記チップ状素子を設ける領域が開口していることを特徴とする配線基板。

【請求項１１】　配線基板上に実装されたチップ状素子を封止する封止部材であって、

水蒸気を透過する水蒸気透過性部材と、水蒸気を透過しない若しくは透過しにくいキャップ部からなり、

前記チップ状素子の体積よりも大きい空間を有する凹部が設けられていることを特徴とする封止部材。

【請求項１２】　前記水蒸気透過性部材はフィルム状であり、前記キャップ部の、前記凹部の開口面側に設けられていることを特徴とする、請求項１１に記載の封止部材。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電子装置及びその製造方法に関し、特に、弾性表面波素子を用いた電子装置に適用して有効な技術に関するものである。

【０００２】

【従来の技術】従来、携帯電話などの移動体通信機器用の帯域通過フィルタ（バンドパスフィルタ）には、弾性表面波（Surface Acoustic Wave；以下、ＳＡＷと称する）を利用したＳＡＷフィルタ素子が用いられている。

【０００３】前記ＳＡＷフィルタ素子は、例えば、ニオブ酸リチウム（$LiNbO_3$）やタンタル酸リチウム（$LiTaO_3$）、水晶などの圧電基板の表面に、すだれ状電極（櫛型電極）が設けられた素子である。このとき、前記すだれ状電極は、表面波を励起振動する入力用の電極と、前記励起振動された表面波を受信して電気信号に変換する出力用の電極とが設けられる。またこのとき、前記すだれ状電極には、大きく分けて、遅延型の電極構造と共振型の電極構造とがあり、用途や特性に合わせて選択される。

【０００４】前記ＳＡＷフィルタ素子では、前記入力用のすだれ状電極に交流電圧（電気信号）を印加すると、圧電効果により前記圧電基板に歪みが生じて表面波が励起され、前記圧電基板の表面が振動する。前記圧電基板の表面で振動する表面波は、前記圧電基板上を伝搬して前記出力用のすだれ電極に到達し、受信される。

【０００５】このとき、励起される表面波の周波数は、前記すだれ状電極の周期（間隔）に依存する。そのため、前記出力用のすだれ状電極では、特定の周波数の表面波（電気信号）のみを受信でき、帯域通過フィルタとして用いることができる。

【０００６】また、前記ＳＡＷフィルタ素子を用いた電子装置は、前記ＳＡＷフィルタ素子の表面に、前記表面波を励起し、伝搬するための空間が必要であるため、従来、セラミックパッケージ形態のものが用いられている。

【０００７】前記セラミックパッケージは、配線が作りこまれたセラミックケース内に前記ＳＡＷフィルタ素子を接着し、前記ＳＡＷフィルタ素子の外部端子と前記セラミックケースの配線（端子）とをボンディングワイヤで接続し、前記セラミックケースの開口部を金属あるいはセラミック製のキャップで閉じている。

【０００８】しかしながら、前記セラミックパッケージの場合、前記セラミックケースの体積が大きく、比重も大きいので、装置が大型で重くなる。そのため、前記移動体通信機器の小型化、軽量化が難しいという問題があった。

【０００９】そこで、近年では、前記ＳＡＷフィルタ素子を用いた電子装置を小型化、軽量化するために、ＢＧＡ（Ball Grid Array）やＣＳＰ（Chip Size Package）といった半導体装置のように、テープ状の絶縁基板の表面に配線を形成した配線基板（テープキャリア）上に、前記ＳＡＷフィルタ素子をフリップチップ実装し、前記ＳＡＷフィルタ素子の周囲を絶縁体で封止する方法が提案されている。

【００１０】前記テープキャリア上に前記ＳＡＷフィルタ素子を実装した前記電子装置としては、例えば、図７に示すように、絶縁基板１上に配線２が設けられた前記テープキャリア（誘電体基板）上に、前記ＳＡＷフィルタ素子３をフリップチップ実装、すなわち、前記ＳＡＷフィルタ素子のすだれ状電極３０２の端子部と前記配線２を導電部材（金バンプ）４で接続した後、前記ＳＡＷフィルタ素子３上に封止用フィルム７をかぶせ、前記フィルム７の外周部と前記テープキャリアを接着し、内部に空洞６を設けたものがある（特開平１０－１２５８２５号公報参照）。

【００１１】また、前記ＳＡＷフィルタ素子を用いた電子装置に限らず、例えば、ＧａＡｓＦＥＴ（Field Effect Transistor）などの高周波動作をする半導体チップを用いた半導体装置でも、内部に空洞を設けたものがある。

【００１２】前記ＧａＡｓＦＥＴなどの半導体チップを用いた半導体装置では、前記半導体チップを前記テープキャリア上にフリップチップ実装した後、前記半導体チップと前記テープキャリアの間をアンダーフィル材で封止してしまうと、前記アンダーフィル材の誘電率により信号遅延などが起きて、特性が劣化する。そのため、例えば、図８に示すように、絶縁基板１の表面に配線２が形成されたテープキャリア上に、前記半導体チップ８を

フリップチップ実装して前記半導体チップの外部端子８０１と前記配線２を導電部材４で接続し、前記半導体チップ８の外周部だけに熱硬化性樹脂９を設け、前記テープキャリアと半導体チップ８の間に空洞６を設けた半導体装置が提案されている（特開２０００－１６４６３５号公報参照）。

【００１３】前記図８に示したような半導体装置では、前記半導体チップ８の回路形成面８Ａ上が空洞６になっているため、高周波動作をさせたときにも信号遅延などが起きにくく、特性の劣化を防げる。

【００１４】

【発明が解決しようとする課題】しかしながら、前記従来の技術では、前記電子装置の内部に空洞６を設けた場合、例えば、前記電子装置を実装基板に実装（はんだ付け）する際の加熱などにより、前記装置内の空気が膨張し、内部（中空部）の気圧が上昇する。

【００１５】このとき、例えば、前記特開平１０－１２５８２５号公報に記載されたような封止用フィルム７を用いて封止した装置では、図７に示したように、前記封止用フィルム７が膨張することで、空洞６の圧力を下げることができるが、膨張することにより前記封止用フィルム７に負荷がかかり、前記ＳＡＷフィルタ素子３やテープキャリアから剥がれるという問題があった。

【００１６】また、前記特開２０００－１６４６３５号公報に記載された半導体装置のようにすると、中空部（空洞６）の空気が膨張することにより、配線２と導電部材４の接続部、あるいは半導体チップの外部端子８０１と導電部材４の接続部が剥がれ、接続不良になるという問題があった。

【００１７】また、図７及び図８に示した電子装置（半導体装置）の場合、前記空洞６と装置の外部が封止用の絶縁体で遮断されているため、前記空洞６や前記封止材料が吸湿した水分による導通不良が起こりやすいという問題があった。

【００１８】また、図７に示したような、封止用フィルム７を用いた電子装置の場合、前記封止用フィルム７の変形により、前記電子装置の外観形状にばらつきが生じる。また、前記封止用フィルム７が薄くて破れやすいため、実装時などの取り扱いが難しいという問題があった。

【００１９】また、例えば、前記特開２０００－１６４６３５号公報に記載された半導体装置のようにすると、前記半導体チップ８を実装したときに前記熱硬化性樹脂９が広がるが、その広がり量の制御が難しい。そのため、半導体装置ごとに、前記空洞の体積にばらつきが生じやすく、動作特性にばらつきが生じやすいという問題があった。

【００２０】本発明の目的は、内部に空洞を設けた電子装置において、空洞内の水蒸気の膨張による、空洞部の圧力の上昇を抑制することが可能な技術を提供することにある。本発明の他の目的は、内部に空洞を設けた電子装置において、耐熱衝撃性を向上させることが可能な技術を提供することにある。本発明の他の目的は、内部に空洞を設けた電子装置において、空洞内の水蒸気による導通不良を防ぐことが可能な技術を提供することにある。本発明の他の目的は、内部に空洞を設けた電子装置において、空洞部の体積の制御を容易にすることが可能な技術を提供することにある。本発明の他の目的は、内部に空洞を設けた電子装置において、装置の小型化、軽量化が可能な技術を提供することにある。本発明の前記ならびにその他の目的と新規な特徴は、本明細書の記述および添付図面によって明らかになるであろう。

【００２１】

【課題を解決するための手段】本願において開示される発明の概要を説明すれば、以下のとおりである。

（１）絶縁基板の表面に配線（導体パターン）が設けられた配線基板と、前記配線基板上に設けられたチップ状素子と、前記チップ状素子の外部端子と前記配線基板の配線とを接続する導電部材と、前記チップ状素子の周囲を封止する封止部材からなり、前記配線基板と前記チップ状素子との間に空洞を有する電子装置であって、前記封止部材は、水蒸気を透過する水蒸気透過部材と、水蒸気を透過しない若しくは透過しにくいキャップ部材からなり、前記水蒸気透過部材は、前記空洞内と前記封止部材の外部を連通している電子装置である。

【００２２】前記（１）の手段によれば、前記封止部材に、前記水蒸気透過部材を設けていることにより、前記空洞内の水蒸気（空気）を、前記水蒸気透過部材を通して前記電子装置の外部に放出することができる。そのため、例えば、加熱などにより前記空洞内の水蒸気が膨張して、前記空洞内の圧力が上昇するのを抑制することができる。

【００２３】このとき、前記封止部材は、前記チップ状素子の体積よりも大きい空間を有する凹部を設けておき、前記チップ状素子を、前記配線基板と前記封止部材の凹部で囲まれた空間内に設けることにより、前記外部端子と前記配線とを、前記導電部剤を用いた金属接合で直接接続することができる。そのため、前記外部端子と前記配線との接続強度が高く、剥がれにくい電子装置を得ることができる。

【００２４】また、前記チップ状素子を、前記配線基板と前記封止部材の凹部で囲まれた空洞内に設けるため、前記チップ状素子と前記配線基板の間に封止材料がない。そのため、従来のように、前記チップ状素子の周囲を絶縁体で封止した電子装置に比べ、動作特性のばらつきを低減することができる。

【００２５】またこのとき、前記水蒸気透過部材としてフィルム状の部材を用い、前記フィルム状の水蒸気透過部材を、前記配線基板と前記キャップ部材の間に設けることにより、電子装置を薄型化することが可能である。

また、前記フィルム状の材料を用いることにより、従来のセラミックパッケージに比べ、軽量化が可能になる。

【００２６】また、前記（１）の手段において、前記チップ状素子としては、例えば、圧電材料の表面にすだれ状電極（櫛型電極）が設けられた弾性表面波素子を用い、前記すだれ状電極と前記配線基板が向かい合うように設けるのが好ましい。このとき、前記弾性表面波素子は、前記封止部材と前記配線基板で囲まれた空洞内に設けられているため、前記すだれ状電極が形成された面の全面に空洞ができ、前記弾性表面波素子の特性が劣化するのを防げる。

【００２７】（２）絶縁基板の表面に配線（導体パターン）が形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、前記配線基板は、前記チップ状素子を配置する領域が開口した水蒸気透過性フィルムが形成されており、前記封止工程は、前記チップ状素子上に、水蒸気を透過しない若しくは透過しにくいキャップ部材をかぶせ、前記水蒸気透過性フィルムを介して前記キャップ部材と前記配線基板とを接着する電子装置の製造方法である。

【００２８】前記（２）の手段によれば、前記水蒸気透過性フィルムが形成された配線基板を用い、前記水蒸気透過性フィルムに形成された開口部内に前記チップ状素子を実装し、前記キャップ部材をかぶせて封止することにより、前記チップ状素子と前記配線基板の間に容易に空洞を設けることができる。

【００２９】また、前記配線基板上に前記水蒸気透過性フィルムを形成しておくことにより、前記キャップ部材をかぶせて封止した後でも、前記電子装置の空洞内の水蒸気を、前記水蒸気透過性フィルムを通して前記電子装置の外部に放出することができる。そのため、前記電子装置の加熱時などに、前記空洞内の水蒸気（空気）が膨張して、前記配線基板が剥がれたり、前記配線と前記外部端子の接続部が剥がれたりするのを防げ、耐熱衝撃性の高い電子装置を得ることができる。

【００３０】またこのとき、前記水蒸気透過性フィルム及び前記キャップ部材は、前記チップ状素子の外側を覆うように形成するため、前記チップ状素子と前記配線基板の間には封止部材がない。すなわち、前記チップ状素子は、前記配線基板と向かい合う面の全面が露出するため、空洞の体積のばらつきにより電子装置ごとの動作特性にばらつきが生じることを防げる。

【００３１】（３）絶縁基板の表面に配線（導体パターン）が形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、前記チップ状素子実装工程は、前記配線基板上に、前記チップ状素子を配置する領域が開口した水蒸気透過性フィルムを接着するフィルム接着工程と、前記配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ接続工程とを備え、前記封止工程は、前記チップ状素子上に、水蒸気を透過しない若しくは透過しにくいキャップ部材をかぶせ、前記水蒸気透過性フィルムを介して前記キャップ部材と前記配線基板とを接着する電子装置の製造方法である。

【００３２】前記（３）の手段によれば、前記チップ状素子実装工程において、前記フィルム接着工程と、前記チップ接続工程とを設けることにより、前記水蒸気透過性フィルムに形成された開口部内に前記チップ状素子を実装し、前記キャップ部材をかぶせて封止することで、前記チップ状素子と前記配線基板の間に容易に空洞を設けることができる。

【００３３】また、前記フィルム接着工程と、前記チップ接続工程とを設けることにより、前記キャップ部材をかぶせて封止した後でも、前記電子装置の空洞内の水蒸気を、前記水蒸気透過性フィルムを通して前記電子装置の外部に放出することができる。そのため、前記電子装置の加熱時などに、前記空洞内の水蒸気（空気）が膨張して、前記配線基板が剥がれたり、前記配線と前記外部端子の接続部が剥がれたりするのを防げ、耐熱衝撃性の高い電子装置を得ることができる。

【００３４】またこのとき、前記水蒸気透過性フィルム及び前記キャップ部材は、前記チップ状素子の外側を覆うように形成するため、前記チップ状素子と前記配線基板の間には封止部材がない。すなわち、前記チップ状素子は、前記配線基板と向かい合う面の全面が露出するため、空洞の体積のばらつきにより電子装置ごとの動作特性にばらつきが生じることを防げる。

【００３５】（４）絶縁基板の表面に配線（導体パターン）が形成された配線基板を形成する配線基板形成工程と、前記配線基板形成工程で形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、前記配線基板形成工程は、前記絶縁基板の表面に前記配線を形成する配線形成工程と、前記配線形成工程の後、前記絶縁基板上に、前記チップ状素子を配置する領域が開口した水蒸気透過性フィルムを接着するフィルム接着工程とを備え、前記封止工程は、前記チップ状素子上に、水蒸気を透過しない若しくは透過

しにくいキャップ部材をかぶせ、前記水蒸気透過性フィルムを介して前記キャップ部材と前記配線基板とを接着する電子装置の製造方法である。

【００３６】前記（４）の手段によれば、前記配線基板形成工程において、前記配線形成工程と、前記フィルム接着工程とを設けることにより、前記水蒸気透過性フィルムに形成された開口部内に前記チップ状素子を実装し、前記キャップ部材をかぶせて封止することで、前記チップ状素子と前記配線基板の間に容易に空洞を設けることができる。

【００３７】また、前記フィルム接着工程を設けることにより、前記キャップ部材をかぶせて封止した後でも、前記電子装置の空洞内の水蒸気を、前記水蒸気透過性フィルムを通して前記電子装置の外部に放出することができる。そのため、前記電子装置の加熱時などに、前記空洞内の水蒸気（空気）が膨張して、前記配線基板が剥がれたり、前記配線と前記外部端子の接続部が剥がれたりするのを防げ、耐熱衝撃性の高い電子装置を得ることができる。

【００３８】またこのとき、前記水蒸気透過性フィルム及び前記キャップ部材は、前記チップ状素子の外側を覆うように形成するため、前記チップ状素子と前記配線基板の間には封止部材がない。すなわち、前記チップ状素子は、前記配線基板と向かい合う面の全面が露出するため、空洞の体積のばらつきにより電子装置ごとの動作特性にばらつきが生じることを防げる。

【００３９】（５）絶縁基板の表面に配線（導体パターン）が形成された配線基板上にチップ状素子を配置し、前記配線基板の配線と前記チップ状素子の外部端子とを接続するチップ状素子実装工程と、前記チップ状素子実装工程の後、前記チップ状素子の周囲を、前記配線基板と前記チップ状素子の間に空洞ができるように封止する封止工程とを備える電子装置の製造方法であって、前記封止工程は、前記チップ状素子が実装された配線基板上に、水蒸気を透過する水蒸気透過性部材と、水蒸気を透過しない若しくは透過しにくいキャップ部材とからなり、前記チップ状素子の体積よりも大きい空間を有する凹部が形成された封止部材をかぶせ、前記封止部材と前記配線基板とを接着して封止する電子装置の製造方法である。

【００４０】前記（５）の手段によれば、前記封止工程において、前記チップ状素子が実装された配線基板上に、水蒸気を透過する水蒸気透過性部材と、水蒸気を透過しない若しくは透過しにくいキャップ部材とからなり、前記チップ状素子の体積よりも大きい空間を有する凹部が形成された封止部材をかぶせて封止することで、前記チップ状素子と前記配線基板の間に容易に空洞を設けることができる。

【００４１】また、前記封止部材に前記水蒸気透過性部材を設けることにより、前記封止部材をかぶせて封止した後でも、前記電子装置の空洞内の水蒸気を、前記水蒸気透過性部材を通して前記電子装置の外部に放出することができる。そのため、前記電子装置の加熱時などに、前記空洞内の水蒸気（空気）が膨張して、前記配線基板が剥がれたり、前記配線と前記外部端子の接続部が剥がれたりするのを防げ、耐熱衝撃性の高い電子装置を得ることができる。

【００４２】またこのとき、前記水蒸気透過性部材及び前記キャップ部材は、前記チップ状素子の外側を覆うように形成するため、前記チップ状素子と前記配線基板の間には封止部材がない。すなわち、前記チップ状素子は、前記配線基板と向かい合う面の全面が露出するため、空洞の体積のばらつきにより電子装置ごとの動作特性にばらつきが生じることを防げる。

【００４３】また、前記（２）の手段から前記（５）の手段において、前記チップ状素子実装工程としては、例えば、圧電材料の表面にすだれ状電極（櫛型電極）が設けられた弾性表面波素子を用い、前記すだれ状電極と前記配線基板が向かい合うように設けるのが好ましい。このとき、前記弾性表面波素子は、前記封止部材と前記配線基板で囲まれた空洞内に設けられているため、前記すだれ状電極が形成された面の全面に空洞ができ、前記弾性表面波素子の特性が劣化するのを防げる。

【００４４】（６）絶縁基板の表面に配線（導体パターン）が設けられた配線基板上に、絶縁性の封止材料が設けられており、前記配線基板上の前記封止材料が設けられた面にチップ状素子を設けたときに、前記配線基板と前記チップ状素子の間に空洞が設けられる、電子装置の製造に用いる配線基板であって、前記封止材料は、水蒸気を透過する水蒸気透過性フィルムであり、前記チップ状素子を設ける領域が開口している配線基板である。

【００４５】前記（６）の手段によれば、前記配線基板上に、前記水蒸気透過性フィルムを設けることにより、前記配線基板上に前記チップ状素子を設け、前記チップ状素子の周囲を封止したときに、前記配線基板と前記チップ状素子との間に空洞を容易に設けることができる。

【００４６】また、前記チップ状素子の周囲を封止した後でも、前記空洞内の水蒸気を、前記水蒸気透過性フィルムを通して外部に放出することができる。そのため、前記配線基板を用いることにより、前記空洞内の水蒸気（空気）が膨張して、前記配線基板が剥がれたり、前記配線と前記外部端子の接続部が剥がれたりするのを防げ、耐熱衝撃性の高い電子装置を製造することができる。

【００４７】（７）配線基板上に実装されたチップ状素子を封止する封止部材であって、水蒸気を透過する水蒸気透過性部材と、水蒸気を透過しない若しくは透過しにくいキャップ部からなり、前記チップ状素子の体積よりも大きい空間を有する凹部が設けられている封止部材である。

【００４８】前記（７）の手段によれば、前記封止部材に、前記チップ状素子の体積よりも大きい空間を有する凹部が設けられていることにより、配線基板上に実装されたチップ状素子の周囲を封止する際に、前記チップ状素子と前記配線基板の間に、容易に空洞を設けることができる。

【００４９】また、前記封止部材を用いて前記チップ状素子の周囲を封止した後でも、前記空洞内の水蒸気を、前記水蒸気透過性フィルムを通して外部に放出することができる。そのため、前記封止部材を用いることにより、前記空洞内の水蒸気（空気）が膨張して、前記配線基板が剥がれたり、前記配線と前記外部端子の接続部が剥がれたりするのを防げ、耐熱衝撃性の高い電子装置を製造することができる。

【００５０】またこのとき、前記水蒸気透過性部材はフィルム状であり、前記キャップ部の、前記凹部の開口面側に設けられていることにより、前記封止部材を薄型化することができ、薄型の電子装置を製造することができる。

【００５１】以下、本発明について、図面を参照して実施の形態（実施例）とともに詳細に説明する。なお、実施例を説明するための全図において、同一機能を有するものは、同一符号をつけ、その繰り返しの説明は省略する。

【００５２】

【発明の実施の形態】（実施例１）図１は、本発明による実施例１の電子装置の概略構成を示す模式図であり、図１（ａ）は電子装置の平面図、図１（ｂ）は図１（ａ）に示した電子装置のＡ－Ａ’線での断面図である。

【００５３】図１（ａ）及び図１（ｂ）において、１は絶縁基板、２は配線、２０１は第１導体膜、２０２は第２導体膜（外部端子）、２０３は銅めっき（ビア）、２０４は端子めっき、３はチップ状素子（弾性表面波フィルタ素子）、３０１は圧電基板、３０２はすだれ状電極、４は導電部材（金バンプ）、５は封止部材、５Ａは封止部材の凹部、５０１は水蒸気透過性フィルム、５０２はキャップ部材、６は空洞である。

【００５４】本実施例１の電子装置は、図１に示すように、絶縁基板１の表面に所定パターンの配線２が設けられた配線基板と、前記配線基板上に設けられたチップ状素子３と、前記チップ状素子３の外部端子と前記配線基板の配線２とを接続する導電部材４と、前記チップ状素子３の周囲を封止する封止部材５からなり、前記配線基板（絶縁基板１）と前記チップ状素子３との間に空洞６が設けられている。

【００５５】また、前記配線２は、前記絶縁基板１の第１主面、言い換えると前記チップ状素子３が設けられた面の第１導体膜２０１と、前記絶縁基板１の第１主面の裏面（第２主面）に設けられた第２導体膜２０２と、前記絶縁基板１に設けられた開口部（ビア穴）１Ａを通して前記第１導体膜２０１と前記第２導体膜２０２とを電気的に接続する銅めっき２０３と、前記第２導体膜２０２及び前記銅めっき２０３の表面に設けられた端子めっき２０４からなる。このとき、図示は省略するが、前記端子めっき２０４は、例えば、ニッケルめっきを下地とした金めっきからなる。

【００５６】また、本実施例１の電子装置では、前記チップ状素子３は、圧電基板３０１の表面にすだれ状電極３０２が設けられた弾性表面波フィルタ素子であり、前記すだれ状電極３０２が、前記配線基板（絶縁基板１）と向かい合うように設けられている。このとき、前記すだれ状電極３０２と前記配線基板の配線２を接続する導電部材４には、金バンプを用い、金バンプ４と前記配線２の表面の端子めっき（金めっき）２０４は金金接合とする。

【００５７】また、前記封止部材５は、前記封止部材５は水蒸気を透過する水蒸気透過性フィルム５０１と、水蒸気を透過しない若しくは透過しにくいキャップ部材５０２からなり、前記チップ状素子３の体積よりも大きい空間を有する凹部５Ａが設けられている。そのため、前記チップ状素子３は、前記配線基板（絶縁基板１）と前記封止部材の凹部５Ａで囲まれた空洞６内に設けられている。またこのとき、前記水蒸気透過性フィルム５０１は、前記空洞６と前記封止部材５の外部を連通している。

【００５８】本実施例１の電子装置によれば、前記封止部材５に、前記水蒸気透過フィルム５０１を設けていることにより、前記空洞６内の水蒸気（空気）を、前記水蒸気透過フィルムを通して前記電子装置の外部に放出することができる。そのため、例えば、加熱などにより前記空洞６の水蒸気が膨張して、前記空洞６の圧力が上昇するのを抑制することができる。

【００５９】このとき、前記封止部材５は、図１（ａ）及び図１（ｂ）に示したように、前記チップ状素子３の体積よりも大きい体積の凹部５Ａを設けておき、前記チップ状素子３を、前記配線基板と前記封止部材５の凹部５Ａで囲まれた空洞６に設けることにより、前記弾性表面波フィルタ素子３のすだれ状電極３０２と前記配線基板の配線２（金めっき２０４）とを、前記金バンプ４を用いた金金接合で直接接続することができる。そのため、前記すだれ状電極３０２と前記配線２との接続強度が高く、剥がれにくい電子装置を得ることができる。

【００６０】また、前記水蒸気透過性フィルム５０１を通して、前記空洞６の水分を装置の外部に放出することができるため、空洞６内の水分による導通不良を防ぐことができる。

【００６１】またこのとき、前記水蒸気透過性フィルム５０１を介して、前記配線基板と前記キャップ部材５０２を接着することにより、電子装置を薄型化することが

可能である。また、前記配線基板、前記水蒸気透過性フィルム５０１及び前記キャップ部材５０２を用いることにより、従来のセラミックパッケージに比べ、軽量化が可能になる。

【００６２】また、前記配線基板と前記封止部材の凹部５Ａで囲まれた空洞６に前記弾性表面波フィルタ素子３を設けることにより、前記弾性表面波フィルタ素子３の、前記配線基板と向かい合う面は全面が空洞になる。そのため、前記図８に示したような、従来の、熱硬化性樹脂で周囲を封止した半導体装置に比べ、前記空洞６の体積の制御が容易であり、電子装置ごとに動作特性のばらつきが生じるのを防ぐことができる。

【００６３】図２及び図３は、本実施例１の電子装置の製造方法を説明するための模式図であり、図２（ａ）、図２（ｂ）、図２（ｃ）、及び図２（ｄ）は配線基板を形成する各工程の断面図、図３（ａ）及び図３（ｂ）はチップ状素子を実装して電子装置を製造する各工程の断面図である。

【００６４】以下、図２及び図３に沿って、本実施例１の電子装置の製造方法について説明するが、従来の製造方法と同様の工程については、その詳細な説明を省略する。

【００６５】まず、図２（ａ）に示すように、絶縁基板１の両面に、第１導体膜２０１及び第２導体膜２０２が形成された両面銅張板の所定位置に、開口部（ビア穴）１Ａを形成する。前記絶縁基板１には、例えば、ポリイミドテープやガラス布基材エポキシ樹脂積層板等を用い、前記第１導体膜２０１及び前記第２導体膜２０２には、例えば、電解銅箔や圧延銅箔を用いる。また、前記開口部１Ａは、例えば、炭酸ガスレーザやエキシマレーザなどを用いたレーザエッチングで形成する。

【００６６】次に、図２（ｂ）に示すように、前記第１導体膜２０１の表面全面、及び前記開口部１Ａの内部に銅めっき２０３を形成する。前記銅めっき２０３は、例えば、電気銅めっきにより形成する。

【００６７】次に、図２（ｃ）に示すように、前記銅めっき２０３が積層された第１導体膜２０１、及び前記第２導体膜２０２をエッチング処理して、所定のパターンの配線２を形成した後、前記配線２の表面に端子めっき２０４を形成する。このとき、前記端子めっき２０４は、例えば、ニッケルめっきを下地として金めっきを行い形成する。

【００６８】次に、図２（ｄ）に示すように、前記配線２が形成された絶縁基板１の、チップ状素子３を実装する面に、前記チップ状素子３を配置する領域が開口した水蒸気透過性フィルム５０１を貼り付ける。このとき、前記水蒸気透過性フィルム５０１には、例えば、発泡性のＰＴＦＥ（ポリテトラフルオロエチレン）を用いる。また、図示は省略するが、前記水蒸気透過性フィルム５０１の両面には、接着材層を設けておく。

【００６９】次に、図３（ａ）に示すように、前記水蒸気透過性フィルム５０１の開口部５０１Ａの内部に弾性表面波フィルタ素子３を配置し、前記弾性表面波フィルタ素子３のすだれ状電極（配線）３０２と前記絶縁基板１上の配線２を電気的に接続する。このとき、前記すだれ状電極３０２の端子部分には、金バンプ（導電部材）４を形成しておき、超音波を併用した熱圧着により、前記金バンプ４と前記配線２の端子めっき２０４とを金金接合する。

【００７０】次に、図３（ｂ）に示すように、前記弾性表面波フィルタ素子３上に、所定の深さの凹部５０２Ｂが設けられたキャップ部材５０２をかぶせ、前記キャップ部材５０２と前記水蒸気透過性フィルム５０１とを接着して前記弾性表面波フィルタ素子３を封止し、所定の切断線で切断して個片化すると、図１（ａ）及び図１（ｂ）に示したような電子装置を得ることができる。このとき、前記キャップ部材としては、例えば、４２アロイのような金属材料を用いる。

【００７１】前記手順で形成した電子装置（ＳＡＷフィルタ装置）は、例えば、携帯電話等の移動体通信機器のバンドパスフィルタとして用いられるものであり、実装基板上に実装するときには、前記実装基板の配線と、前記電子装置の配線２（外部端子２０２）とをはんだ付けする。そのため、前記はんだ付けの際に、前記電子装置が加熱され、前記空洞６の水蒸気（空気）が膨張するが、膨張した水蒸気が前記水蒸気透過性フィルム５０１を通して前記電子装置の外部に放出され、前記空洞６の圧力が上昇するのを抑制することができる。

【００７２】また、前記電子装置の加熱により前記空洞６の圧力が上昇するのを抑制することができるため、前記配線基板の剥がれなどによる装置の信頼性の低下を防ぐことができる。

【００７３】以上説明したように、本実施例１の電子装置によれば、前記チップ状素子（弾性表面波フィルタ素子）３を封止する封止部材５に、水蒸気透過性フィルム５０１を設けることにより、加熱などにより空洞６の水蒸気（空気）が膨張したときに、前記水蒸気を電子装置の外部に放出することができ、空洞６の圧力が上昇するのを抑制することができる。

【００７４】また、前記電子装置の加熱により前記空洞６の圧力が上昇するのを抑制することができるため、前記配線基板の剥がれなどによる装置の信頼性の低下を防ぐことができる。

【００７５】また、前記封止部材５に、前記チップ状素子３の体積よりも大きい体積の凹部５Ａを設けておき、前記チップ状素子３を、前記配線基板と前記封止部材５の凹部５Ａで囲まれた空洞６に設けることにより、前記弾性表面波フィルタ素子３のすだれ状電極３０２と前記配線基板の配線２（金めっき２０４）とを、前記金バンプ４を用いた金金接合で直接接続することができる。そ

のため、前記すだれ状電極３０２と前記配線２との接続強度が高く、剥がれにくい電子装置を得ることができる。

【００７６】また、前記水蒸気透過性フィルム５０１を介して、前記配線基板と前記キャップ部材５０２を接着することにより、従来のセラミックパッケージに比べ、軽量化が可能になる。また、前記キャップ部材５０２の、前記弾性表面波フィルタ素子３上の部分の厚さを薄くしたり、前記キャップ部材５０２と前記弾性表面波フィルタ素子３の隙間を狭くしたりすることにより、前記セラミックパッケージに比べ、装置の薄型化が可能になる。

【００７７】また、前記配線基板と前記封止部材の凹部５Ａで囲まれた空洞６に前記弾性表面波フィルタ素子３を設けることにより、前記弾性表面波フィルタ素子３の、前記配線基板と向かい合う面は全面が空洞になる。そのため、従来の、前記図８に示した半導体装置のように、熱硬化性樹脂で周囲を封止した場合に比べ、前記空洞６の体積の制御が容易であり、電子装置ごとに動作特性のばらつきが生じるのを防ぐことができる。

【００７８】（実施例２）図４乃至図６は、本発明による実施例２の電子装置の製造方法を説明するための模式図であり、図４（ａ）、図４（ｂ）、及び図４（ｃ）は配線基板を形成する工程の断面図、図５（ａ）はチップ状素子を実装する工程の断面図、図５（ｂ）は封止部材の断面図、図６は封止する工程の断面図である。

【００７９】本実施例２の電子装置の製造方法は、前記実施例１で説明した、図１（ａ）及び図１（ｂ）に示した電子装置の他の製造方法である。以下、図４乃至図６に沿って、本実施例２の電子装置の製造方法について説明するが、従来の製造方法と同様の工程については、その詳細な説明を省略する。

【００８０】まず、図４（ａ）に示すように、絶縁基板１の両面に、第１導体膜２０１及び第２導体膜２０２が形成された両面銅張板の所定位置に、開口部（ビア穴）１Ａを形成する。前記絶縁基板１には、例えば、ポリイミドテープやガラス布基材エポキシ樹脂積層板等を用い、前記第１導体膜２０１及び前記第２導体膜２０２には、例えば、電解銅箔や圧延銅箔を用いる。また、前記開口部１Ａは、例えば、炭酸ガスレーザやエキシマレーザなどを用いたレーザエッチングで形成する。

【００８１】次に、図４（ｂ）に示すように、前記第１導体膜２０１の表面全面、及び前記開口部１Ａの内部に銅めっき２０３を形成する。前記銅めっき２０３は、例えば、電気銅めっきにより形成する。

【００８２】次に、図４（ｃ）に示すように、前記銅めっき２０３が積層された第１導体膜２０１、及び前記第２導体膜２０２をエッチング処理して、所定のパターンの配線２を形成した後、前記配線２の表面に端子めっき２０４を形成する。このとき、前記端子めっき２０４は、例えば、ニッケルめっきを下地として金めっきを行い形成する。

【００８３】次に、図５（ａ）に示すように、前記弾性表面波フィルタ素子３のすだれ状電極（櫛型電極）３０２と前記絶縁基板１上の配線２を電気的に接続する。このとき、前記すだれ状電極３０２の端子部分には、金バンプ（導電部材）４を形成しておき、超音波を併用した熱圧着により、前記金バンプ４と前記配線２の端子めっき２０４とを金金接合する。

【００８４】次に、図５（ｂ）に示すように、水蒸気透過性フィルム５０１を貼り付けたキャップ部材５０２に、前記弾性表面波フィルタ素子３の体積よりも大きい空間を有する凹部５Ａを形成した封止部材５を準備する。このとき、例えば、前記水蒸気透過性フィルム５０１には発泡性のＰＴＦＥを用い、前記キャップ部材５０２には４２アロイを用いる。また、図示は省略するが、前記水蒸気透過性フィルム５０１の表面に、接着剤層を設けておく。

【００８５】次に、図６に示すように、前記弾性表面波フィルタ素子３上に、前記封止部材５をかぶせ、前記配線基板（絶縁基板１）と前記水蒸気透過性フィルム５０１とを接着して前記弾性表面波フィルタ素子３を封止し、所定の切断線で切断して個片化すると、図１（ａ）及び図１（ｂ）に示したような電子装置を得ることができる。

【００８６】前記手順で形成した電子装置（ＳＡＷフィルタ装置）は、例えば、携帯電話等の移動体通信機器のバンドパスフィルタとして用いられるものであり、実装基板上に実装するときには、前記実装基板の配線と、前記電子装置の配線２（外部端子２０２）とをはんだ付けする。そのため、前記はんだ付けの際に、前記電子装置が加熱され、前記空洞６の水蒸気（空気）が膨張するが、膨張した水蒸気が前記水蒸気透過性フィルム５０１を通して前記電子装置の外部に放出され、前記空洞６の圧力が上昇するのを抑制することができる。

【００８７】また、前記電子装置の加熱により前記空洞６の圧力が上昇するのを抑制することができるため、前記配線基板の剥がれなどによる装置の信頼性の低下を防ぐことができる。

【００８８】以上説明したように、本実施例２の電子装置の製造方法によれば、前記チップ状素子（弾性表面波フィルタ素子）３を封止する封止部材５に、水蒸気透過性フィルム５０１を設けることにより、加熱などにより空洞６の水蒸気（空気）が膨張したときに、前記水蒸気を電子装置の外部に放出することができ、空洞６の圧力が上昇するのを抑制することができる。

【００８９】また、前記電子装置の加熱により前記空洞６の圧力が上昇するのを抑制することができるため、前記配線基板の剥がれなどによる装置の信頼性の低下を防ぐことができる。

【００９０】また、前記封止部材５に、前記チップ状素子３の体積よりも大きい体積の凹部５Ａを設けておき、前記チップ状素子３を、前記配線基板と前記封止部材５の凹部５Ａで囲まれた空洞６に設けることにより、前記弾性表面波フィルタ素子３のすだれ状電極３０２と前記配線基板の配線２（金めっき２０４）とを、前記金バンプ４を用いた金金接合で直接接続することができる。そのため、前記すだれ状電極３０２と前記配線２との接続強度が高く、剥がれにくい電子装置を得ることができる。

【００９１】また、前記水蒸気透過性フィルム５０１を通して、前記空洞６の水分を装置の外部に放出することができるため、空洞６内の水分による導通不良を防ぐことができる。

【００９２】また、前記水蒸気透過性フィルム５０１を用い、前記水蒸気透過性フィルム５０１を介して、前記配線基板と前記キャップ部材５０２を接着することにより、従来のセラミックパッケージに比べ、軽量化が可能になる。また、前記キャップ部材５０２の、前記弾性表面波フィルタ素子３上の部分の厚さを薄くしたり、前記キャップ部材５０２と前記弾性表面波フィルタ素子３の隙間を狭くしたりすることにより、前記セラミックパッケージに比べ、装置の薄型化が可能になる。

【００９３】また、前記配線基板と前記封止部材の凹部５Ａで囲まれた空洞６に前記弾性表面波フィルタ素子３を設けることにより、前記弾性表面波フィルタ素子３の、前記配線基板と向かい合う面は全面が空洞になる。そのため、従来の、前記図８に示した半導体装置のように、熱硬化性樹脂で周囲を封止した場合に比べ、前記空洞６の体積の制御が容易であり、電子装置ごとに動作特性のばらつきが生じるのを防ぐことができる。

【００９４】以上、本発明を、前記実施例に基づき具体的に説明したが、本発明は、前記実施例に限定されるものではなく、その要旨を逸脱しない範囲において種々変更可能であることはもちろんである。

【００９５】例えば、前記実施例１及び前記実施例２では、前記キャップ部材５０２として、４２アロイを用いたが、これに限らず、他の金属材料や、例えば、熱硬化性樹脂などの絶縁材料を用いてもよい。

【００９６】また、前記実施例１及び前記実施例２では、前記チップ状素子３として、圧電基板３０１の表面にすだれ状電極（櫛型電極）３０２が形成された弾性表面波フィルタ素子を用いた電子装置及びその製造方法について説明したが、これに限らず、例えば、共振子（発振子）として用いる弾性表面波素子を用いてもよい。また、前記チップ状素子３は、前記弾性表面波素子に限らず、ＧａＡｓＦＥＴ（Field Effect Transistor）のような、高周波動作をする半導体チップを用いた半導体装置に適用してもよい。

【００９７】前記高周波動作をする半導体チップでは、回路形成面、すなわち外部端子が形成された面が絶縁性の樹脂で封止されていると、封止樹脂の誘電率による信号遅延などが起きて、高周波特性が劣化する。そのため、図１（ｂ）に示したような構成にすることで、前記半導体チップの回路形成面上に空洞６ができ、高周波特性の劣化を防ぐことができる。

【００９８】

【発明の効果】本願において開示される発明のうち、代表的なものによって得られる効果を簡単に説明すれば、以下のとおりである。

（１）内部に空洞を設けた電子装置において、空洞内の水蒸気の膨張による、空洞部の圧力の上昇を抑制することができる。

（２）内部に空洞を設けた電子装置において、耐熱衝撃性を向上させることができる。

（３）内部に空洞を設けた電子装置において、空洞内の水蒸気による導通不良を防ぐことができる。

（４）内部に空洞を設けた電子装置において、空洞部の体積の制御を容易にすることができる。

（５）内部に空洞を設けた電子装置において、装置を小型化、軽量化できる。

【図面の簡単な説明】

【図１】本発明による実施例１の電子装置の概略構成を示す模式図であり、図１（ａ）は電子装置の平面図、図１（ｂ）は図１（ａ）のＡ－Ａ’線での断面図である。

【図２】本実施例１の電子装置の製造方法を説明するための模式図であり、図２（ａ）、図２（ｂ）、及び図２（ｃ）はそれぞれ、配線を形成する各工程の断面図、図２（ｄ）は水蒸気透過性フィルムを接着する工程の断面図である。

【図３】本実施例１の電子装置の製造方法を説明するための模式図であり、図３（ａ）はチップ状素子を実装する工程の断面図、図３（ｂ）はチップ状素子を封止する工程の断面図である。

【図４】本発明による実施例２の電子装置の製造方法を説明するための模式図であり、図４（ａ）、図４（ｂ）、及び図４（ｃ）はそれぞれ、配線基板を形成する各工程の断面図である。

【図５】本実施例２の電子装置の製造方法を説明するための模式図であり、図５（ａ）はチップ状素子を実装する工程の断面図、図５（ｂ）はチップ状素子を封止する封止部材の構成を示す断面図である。

【図６】本実施例２の電子装置の製造方法を説明するための模式図であり、チップ状素子を封止する工程の断面図である。

【図７】従来の、内部に空洞を有する電子装置の概略構成を示す模式断面図である。

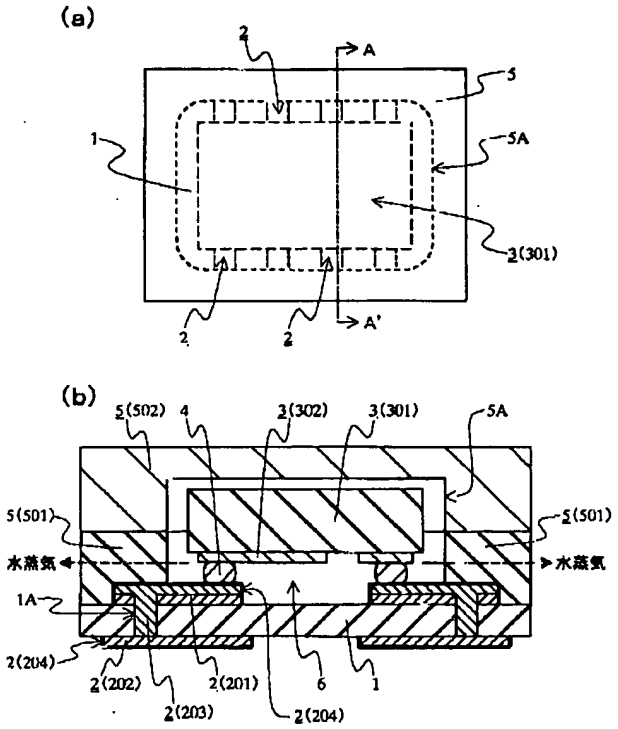
【図８】従来の、内部に空洞を有する電子装置の他の概略構成を示す模式断面図である。

【符号の説明】

1…絶縁基板、1A…開口部（ビア穴）、2…配線、201…第1導体膜、202…第2導体膜、203…銅めっき（ビア）、204…端子めっき、3…チップ状素子（弾性表面波フィルタ素子）、301…圧電基板、302…すだれ状電極（櫛型電極）、4…導電部材（金バンプ）、5…封止部材、501…水蒸気透過性フィルム、502…キャップ部材、6…空洞、7…封止用フィルム、8…半導体チップ、801…ボンディングパッド、9，10…熱硬化性樹脂。

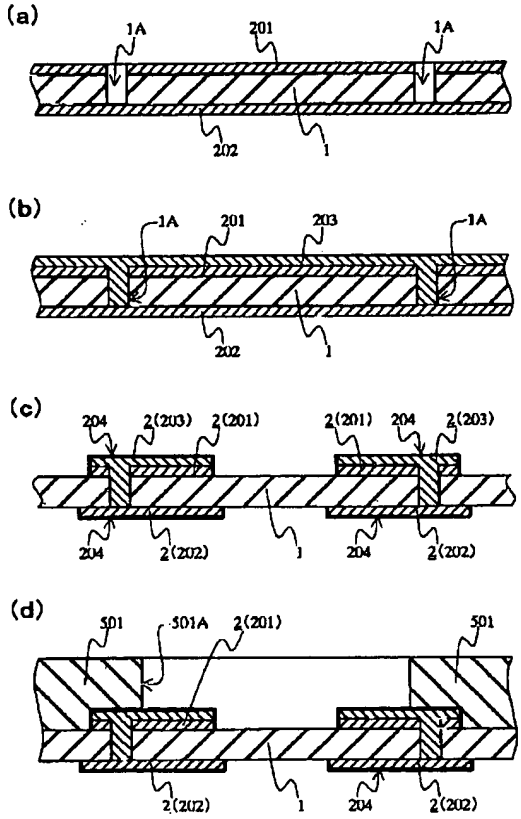
【図1】

図1



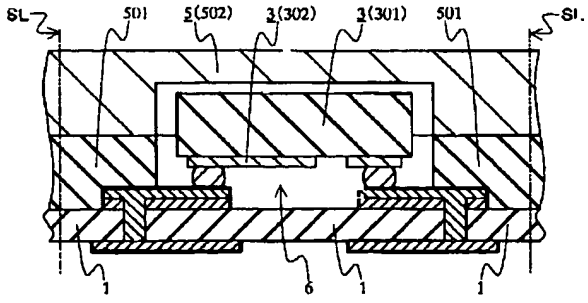
【図2】

図2



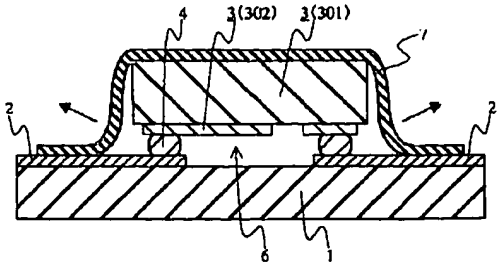
【図6】

図6



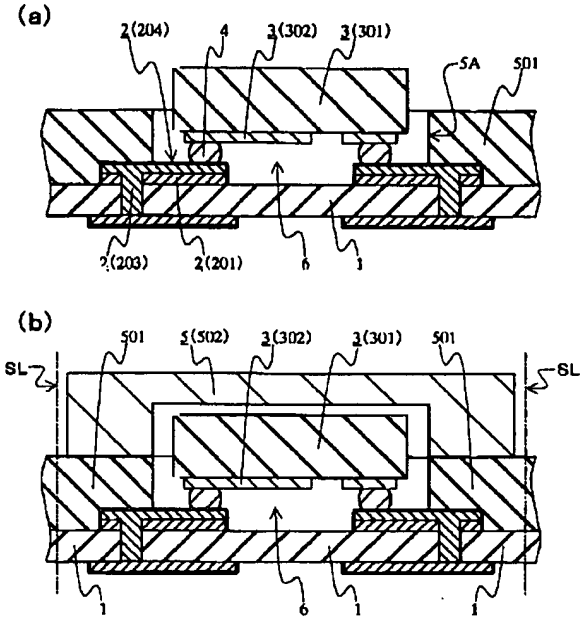
【図7】

図7



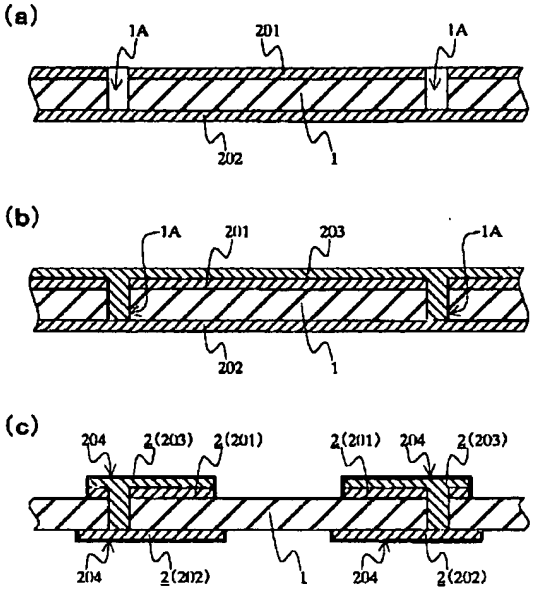
【図3】

図3



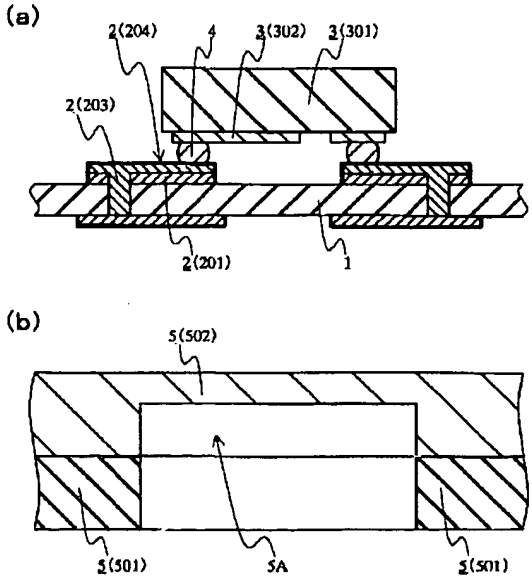
【図4】

図4



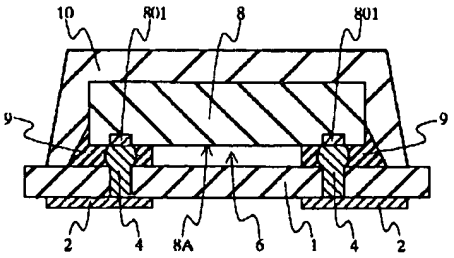
【図5】

図5



【図8】

図8



フロントページの続き

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